

Aviation Week & Space Technology

January 7, 1963

SPECIAL REPORT:

Lockheed C-130
STOL Version

75 Cents

A McGraw-Hill Publication

Philco 40-ft. X-Y
Tracking Antenna





No one has ever combined high resolution
and long wear in a telemetry tape...



until now.

In Soundcraft's new HRM Telemetry Tape, outstanding short wavelength sensitivity and long wear are combined to give you flawless high data rate recording. It's the long term wearability has been previously found only in heavy duty computer tapes, the achievement of this quality in HRM represents a major advance in the state of the art. In tests on conventional telemetry tape, it has been run 600,000 hours without any-

dered of any signal deterioration. The specially developed double coating operates through all atmospheric temperature, humidity and speed ranges without local flaking or deposit build-up on tape (receptors). Equals or exceeds requirements of MIL-T-21229-A. Exclusive use of DuPont's polyester "Mylar" base contributes to strength and reliability. Complete references on request. **REEVES SOUNDGRAFT CORP.** 400 Oldster Drive, Pasadena, Calif. • New York, N.Y. 10017 • Chicago, Ill. 60606 • Los Angeles, Calif. 90007 • Dallas, Texas 75201

AEROSPACE CALENDAR

- Jan 14-15—Automotive Engineering Congress and Exposition, Society of Automotive Engineers, Civic Hall, Detroit, Mich.
- Jan 15-16—Aerospace Transport Symposium, Conference Area, Los Angeles, California, sponsored by Wright-Patterson University, Dayton, Ohio.
- Jan 15-17—North Annual Meeting, American Astronautical Society, Radio Station Hotel, Los Angeles, Calif.
- Jan 21-22—Annual Meeting, Aeronautical Society of America, National Aeronautics Club, Washington, D.C.
- Jan 22-23—11th Annual Meeting (including Weight Budgets Lecture), Institute of the Aerospace Sciences, Hotel Astor, New York, N.Y., Hannon-Naught Dinner, Jan. 22.
- Jan 21-24—13th Aeronautical Symposium, Aeronautical Society, New York, N.Y.
- Jan 22-24—North National Symposium on Suburbity and Density Control, Sheraton Palace Hotel, San Francisco, Calif.
- Jan 24—8th Convective Aircraft Conference, Fairfield Institute, Philadelphia, Pa.
- Jan 25-18th Annual Aero-Astronautics Conference, International Astronautical Society, Washington, D.C.
- Jan 26 Feb 1—Fourth Annual Solid Fuel Rocket Section Conference, American Rocket Society, Ballroom Sheraton Hotel, and the Franklin Institute, Philadelphia, Pa.
- Jan 30-Feb 1—National Winter Conference on Military Electronics, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.

(Check send to page 7)

AVIATION WEEK and Space Technology

January 7, 1963
Vol. 78, No. 1

... (Detailed text from the magazine page, including articles on space technology and aviation news) ...

Subscription rates: Single copies 10¢. Annual subscription \$10.00. Single copies 10¢. Annual subscription \$10.00. Single copies 10¢. Annual subscription \$10.00.

x^2
square a number...
 \sqrt{x}
extract a square root,



on the Friden SRQ—automatically!

The Friden SRQ is the only desk calculator in the world that provides both automatic squaring of numbers, plus automatic extraction of square roots.

To square a number, simply enter it on the keyboard and touch one key. The answer instantly appears in the upper dial.

You can also square a number, add or subtract it from a running total, all in the same operation.

To extract a square root, simply enter the radicand on the keyboard and touch one key. The square root instantly appears in the lower dial. Only the Friden Model SRQ offers

these unique features as an easy-to-use, fully-automatic, desk calculator. Two other new Friden Calculators, the Model SRQ and the Model STQ, offer you automatic squaring, along with a whole array of other automatic features. Every engineer and statistician should have one.

For a no-obligation, 10-minute demonstration, call your local Friden area Or write Friden, Inc., San Leandro, California.

Friden

Circle 11 on Reader Service Card

VENTIL
AIRCRAFT



ELECTRONIC
INNOVATION



The solution to many space
age problems lies within

Ryan's spectrum of capabilities

These notable breakthroughs by Ryan scientist-engineer teams, demonstrate proven capability to create the necessary technology and to manage every phase of new, complex systems.

- Design, build and fly the world's first jet VTOL airplane. This apply over three million man hours of VTOL experience to construct such modern aircraft as the Army's XV-5A (V) fan aircraft.
- Take a crescent like the Rogallo wing and develop a successful test bed vehicle with broad applications—the Ryan Flex Wing.
- Pioneer the C-17 Doppler provide true world leadership in the production of electronic navigation systems for all types of aircraft now flying or planned.
- Develop complete jet target systems like the famed Ryan Freebee—most widely used target jet in the free world.
- Design and fabricate radar altimeters, precision altimeter and space structures for such advanced space vehicles as Altair 2, Teklon, Skerper.

From advanced altimeters to the fabrication of space age metals, Ryan is prepared to assist government and industry in studies, design, development, production, and the field support of complete aerospace systems and equipment.

RYAN AERONAUTICAL COMPANY, SAN DIEGO, CALIFORNIA

RYAN
AERONAUTICAL COMPANY

SPACE
STRUCTURES



AIRCRAFT
COMPONENTS



ROCKET
ALTIMETERS



ADVANCED
METAL PRODUCTS



AEROSPACE CALENDAR

(Continued from page 5)

- Feb. 3—Fundamental Fluorocines in the Mineral Sciences Symposium, Hotel Sheraton Plaza, Boston, Mass. Sponsor: Mineralogy.
- Feb. 14—Symposium on Engineering for Major Scientific Programs, Georgia Institute of Technology, Atlanta, Ga.
- Feb. 17—Advances in Metallurgy Symposium, American Society of Test and Materials Meeting, Engineers, Park Sheraton Hotel, New York, N. Y.
- Feb. 17—19th Meeting, National Aerospace Standards Committee of the Aerospace Industries Assn., Anaheim Hotel, Los Angeles, Calif.
- Feb. 11-15—Third International Symposium on Quantum Electronics, UNESCO Building, First Floor, Symposium International Centre for Telesp. Coord., Office of Naval Research, La Jolla, California.
- Feb. 11-15—Space Vehicle Thermal and Atmospheric Control Symposium, conducted by the Astronautical Systems Division Engineers Club, Dayton, Ohio. Sponsor: NASA's Flight Research Laboratory.
- Feb. 13-Apr. 24—International Astronautical and Space Fair, Congress and Conference, Houston, Tex. San Paulo, Brazil. Sponsor: Soviet Cosmonaut Federation.
- Feb. 20-21-1963 International Robot Show, Caracas Conference, Philadelphia, Pa. Sponsor: Institute of Radio Engineers, American Institute of Electrical Engineers, University of Pennsylvania.
- Feb. 21-23—Missions Report, Clarkston, Ga. Sponsor: Society for Quality Control, Thompson Hotel, Las Vegas, Nev.
- Mar. 17—Seventh Annual Radioactive Gas Turbine, Aviation and Space Meeting, American Society of Mechanical Engineers, State Hilton Hotel, Los Angeles, Calif.
- Mar. 24—Psychology Meeting, Institute of the Aerospace Sciences, Cleveland, Ohio.
- Mar. 11-13—General Flightgear Conference, American Rocket Society, Southwestern Hotel, California Springs, Calif.
- Mar. 14-20—Space Flight Training Course, cosponsored by American Rocket Society and Institute of the Aerospace Sciences, Cocoa Beach, Fla.
- Mar. 18-21-1963 Western Metall Exposition and Congress, Pan Pacific Auditorium and Convention Hotel, Los Angeles.
- Mar. 19-21—General Air Force-sponsored Symposium on Defense Defense Hotel, Detroit, Ohio.
- Mar. 21-18—International Conversion Institute of Radio Engineers, Waldorf Astoria and Coliseum, New York, N. Y.
- Apr. 1-3—Fourth Annual Structures and Materials Conference—American Rocket Society and Institute of the Aerospace Sciences, El Monte Hotel, Irvine, Calif.
- Apr. 2-3—Sixth Annual Spacecraft Safety Seminar, Flight Safety Institute, San Bernardino Plaza, New York, N. Y.
- Apr. 15—Spring Conference, Airport Operations Council, Sheraton Hotel, Washington, D. C.
- Apr. 18-19—Fourth Symposium on Engineering Aspects of Magnetohydrodynamic, University of California, Berkeley. (Continued on page 6)

MICROPEX® multi-purpose cathode ray tubes used in high resolution applications, are part of the extensive line of EITRON display devices and microchannel tubes. San Carlos, California, in Europe Box 110, Zurich 80, Switzerland.

LITTON INDUSTRIES
ELECTRON TUBE DIVISION



PROBLEMATICAL RECREATIONS 152



Between Kroffite and Berline are five other towers. The seven towers are an integral number of miles from either ring; a straight road. The towers are so spaced that if one knows the number of miles a person has traveled between any two towers, he can determine the particular tower he occupies. What is the maximum distance between Kroffite and Berline to make this possible?

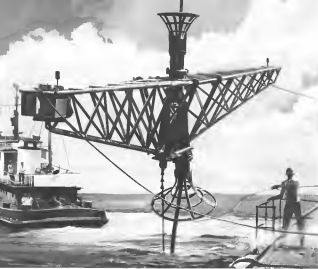
—Coushland

If you're had at least five years' experience in digital data processing systems, let Mr. William T. Short at our Data Systems Division know about you. Systems Engineers are needed to direct those areas of activity: logical data systems, active tracking, radio/computer interface, digital communications, and mixed analog/digital systems. You would supervise system integration problems, formulate solutions to terms of required systems parameters, work with and/or direct designers in implementation.

ANSWER TO LARRY WHEAT'S PROBLEM: The missing number is 31. The terms of the sequence are the reciprocals of 16 to various bases starting with base 16 and proceeding consecutively to base 2.

An Equal Opportunity Employer

LITTON SYSTEMS, INC.
Data Systems Division
Cinco Park, California



Putting ears in the ocean

Unique underwater sound laboratory built by Lockheed helps U.S. Navy measure submarine noise.

The sea is saturated with sounds—the motion of the waves, the rubbing of ships and the babble of marine life. Before any single sound—such as the noise of a distant submarine—may be as difficult as hearing a pebble tossed into a puddle during a thunderstorm.

The U. S. Navy has embarked upon a high-priority underwater test facility known as the Atlantic Undersea Test and Evaluation Center (AUTEC). This undertaking may well achieve important breakthroughs to the nation's achievement in space.

Lockheed Electronics Company was chosen by the Navy as team manager to direct the design and installation of the first operational range of this vast program.

Innovative Designers of Lockheed engineers designed and developed a battery-powered acoustic array, involving a sensitive hydrophone system for the surveillance, detection and measurement of underwater sounds.

Practical Designers of Lockheed housed the system to operate efficiently under the onerous pressure and other adverse conditions encountered underwater.

Engineering Follow-through from

Lockheed directed the installation of the hydrophone array in deep water—and completed test and check-out of the system to assure optimum operation in this environment.

Lockheed offers these transfer engineers, practical designers and engineering follow-through capabilities to the defense and civilian electronics industries alike. LEC is the electronics gateway to several thousand scientists, engineers and technologists who work for Lockheed.

Engineers and Scientists: For unique advancement opportunities with this talented team, please contact our Professional Placement Office, Philadelphia, N. J. An equal opportunity employer.

LOCKHEED ELECTRONICS COMPANY
PLAINFIELD, NEW JERSEY A Division of Lockheed Aircraft Corporation

AEROSPACE CALENDAR

(Continued from page 7)

- Apr. 15-17—Hypersonic Research Center, American Rocket Society and American Society of Mechanical Engineers, Naval Ordnance Laboratory, White Oak, Md.
- Apr. 17-18—International Nonlinear Magnetism (INTERMAG) Conference, Stanford, Calif., Washington, D. C., Squawton, American Institute of Electrical Engineers, IEE.
- Apr. 17-20—Southwestern Combustion and Electronic Space Systems of Radio Engineers, Dallas Memorial Auditorium, Dallas, Tex.
- Apr. 17-19—Tulwood Mating Nuclei Materials for Space Applications, American Nuclear Society, Northbrook Hilton Hotel, Chicago, Ill.
- Apr. 17-21—Annual Meeting, National Aeronautics Research Association, Washington, D. C.
- Apr. 22-24—National Material Space Flight Symposium, Institute of the Aeronautics Sciences in cooperation with NASA and AISC, Dallas, Tex.
- Apr. 22-24—Third Annual Sea Days Symposium for Biomedical Engineering, Ed. Wold's Oceanhouse, San Diego, Calif.
- Apr. 24-25—Search Region Turbulence Conference, IRE, San Jose, Calif.
- Apr. 29-May 3—23rd Annual National Conference, Section of Aeronautical Weight Engineers, Sheraton Jefferson Hotel, St. Louis, Mo.
- Apr. 29-May 3—Annual Conference, Society of Photographic Scientists and Engineers, Andersons Hotel, Miami, Fla., N.E. Conference Area, Broward Office.
- May 1-3-1974—Annual National Forum, American Hydrographer Society, Sheraton Parkland, Washington, D. C.
- May 1-3—Environmental Conference, American Rocket Society and Aerospace Medical Assn., Los Angeles, Calif.
- May 2-3—Fourth National Symposium on Plasma Physics in Electronics, Institute of Radio Engineers, Marriott Twin Bridges Hotel, Washington, D. C.
- May 6—Aerospacer Rehabilitation and Maintenance Methods, Institute of the Aerospace Sciences, Washington, D. C.
- May 7-8—Electronic Components Conference, Institute of Radio Engineers, Marriott Twin Bridges Hotel, Washington, D. C.
- May 10-15—National Aerospace Electronics Conference, IRE, Detroit, Mich.
- May 10-15—Government General Flight Vehicle's Second National Symposium on Air Transportation, Hartford, Conn.
- May 20-22—National Symposium on Micro-wave Diodes and Tubes, Institute of Radio Engineers, Marriott Hotel, Santa Monica, Calif.
- May 18-22—National Telecommunications Conference, Hilton Hotel, Albuquerque, N. M.
- May 21-25—Spring Joint Computer Conference, American Federation of Information Processing Societies, Cobo Hall, Detroit, Mich.
- May 25-28—Search National Conference on Radar Engineering & Evaluation, Institute of Radio Engineers, Coronado Hotel, Gardena, Calif.
- May 27-31—1974 Fourth International Air Show, Le Bourget, Paris, France.



Still . . . the smallest hermetically-sealed snap-acting precision switch ever made!

KLIXON® AT1-1

Three years ago, we introduced the KLIXON AT1-1 as the first sub-miniature, snap-acting switch with a true hermetic seal. Since then, no other switch has approached its small size and light weight . . . has matched its high shock and vibration resistance . . . has achieved a five-year, fielded seal.

That's why AT1-1 series switches have been used in space probes, spacecraft, ASW equipment, aircraft valves, nuclear engine valves, pressure switches, radar equipment, ECM systems, testing and aerospace systems and launching equipment.

Another reason for the wide use of AT1-1 switches is the KLIXON packaging base. These specialists design and build single and multiple pole packages . . . simple and complex . . . with toggle, push-button, lever, attenuator, etc. to meet demanding requirements. For complete information write for bulletin PR5B-11.

AT1-1 includes an optional seal with a variety of hermetic seals such as:



SPECIFICATIONS	
Hermetically sealed	conforming to MIL Standard (Electronic Design) Class A
Reliability Test	30 or 100 hours
Pressure	1,000-4,000 psi
Vibration	500g random
Shock	500g peak
Temperature	-55° to +125°
Control signal type	1-5vdc or 10 to 30 vdc
Control signal level	any 10, 20, 50, 100, 200, 500, 1,000
Switch operation	2000 without leakage
Weight	1.000 max.



METALS & CONTROLS INC.
2851 FORREST ST. ATLANTA, MISS. A CORPORATE DIVISION OF
TEXAS INSTRUMENTS
INCORPORATED

We are heavily involved in exotic instrumentation.



A case in point is cryogenics.

In modern, fully equipped cryogenic development laboratories, a unique combination of Bend's experience is available to help meet your cryogenic instrumentation requirements. Our experience includes 11 years—liquid hydrogen, 23 years—liquid oxygen, and 42 years—precision instrumentation.

Perhaps one of your requirements is the precise measurement of temperature between 20°K and 400°K

with digital readout. We can meet this and other cryogenic instrumentation requirements.

In addition to cryogenics, we are also active in the development of life support systems (both terrestrial and manned space), propellant measurement and control, precision special purpose electronics.

Tell us what you are working on. Tell us what you need. Let us help you. Write us at Development, Iowa, Dept. A.P.R.

Pioneer-Central Division



From Washington—

A CLARIFICATION

that can significantly affect your future visits to the world's most important city

For another the original meaning of a noble word that will be dramatically clarified and confirmed with the opening of The Madison in Washington, D. C., this month.

The word is "hotel". French in origin, "hotel" made its first English appearance in 1644. The literal meaning was "a town mansion" and this is what the early European hotels were. Town mansions of wealthy country lords formerly reserved for their own use during the winter Court season. To the day many impressive private residences in Paris are called "hotels".

In The Madison, the word "hotel" will be restored to its original dignity and meaning.

A Long Felt Need

The need for a luxury hotel in the great Capital metropolis, coming to Washington's most highly placed and discerning visitors, has long been recognized by a group of local businessmen, which I have the honor of leading.

We have felt that in the process of accepting their efficiency in business enterprises the better hotels have lost much of the highly personalized character that distinguishes the great European hotels and this was to be regretted as a part of the traditional hospitality of "Old" Washington. We believe the maintenance by many fine and distinguished American guests of a certain level of service, the individual requirements of the individual guest, are made less real and less interesting by "new" Washington hotel methods.

The Madison's privacy and beauty cannot and will not be moved in the rush of the modern age, and we intend to provide this service and its place in the development of Washington's distinguished guests, as distinguished "town mansions" worthy of their patronage. To this end we have pledged generosity of our resources.

The Madison Atmosphere

While The Madison will be one of the world's most beautiful hotels, its atmosphere will be one of remarkable elegance. Its atmosphere will be distinguished; there will be no place of choice for its use of service, and there will be no one who would be allowed either to be beholder or to witness.

The quiet refinement and gracious taste of The Madison's Federal period decor will be reminiscent of the gracious, unobtrusive atmosphere of Irving and Lower Madison and his wife, "Dolly" Lewis in Washington from their nearby Virginia home, Mount Vernon.

The Madison Service

Individual needs and preferences of guests will be served as the European manner by a multi-lingual staff, with courtesy, discretion, grace, competence and the utmost determination that is due at "the best of the matter".

The style of The Madison goes to privacy will be readily requested. No guest accommodations will be within sight or hearing of any delivery or service staff. Drivers and messengers will be clothed with the most effective sound insulation known to modern building science.

And a first policy of "No Cigarettes, No Ties, Cigars" will be maintained to be precise. The atmosphere of The Madison way of life cannot be achieved casual and to assure an adequate supply of accommodations to regular patrons in all seasons.

The service of food and drink at The Madison will be in the great and best European tradition. It is our aim to make The Madison's atmosphere, of the main lobby, a place for conversation at least formal but always done and the highest standards of service and style. In the dining room, the bar, the lounge and the kitchen, the service, the use of the finest food and drink, will be made to make for privacy, a high standard of service, and the highest standards of service. The Madison's atmosphere will be known, appreciated, as it is in the "old" hotels, "in corner of Paris".

A Pledge

It is our determination to maintain, in The Madison, the highest standards of service in the most distinguished service hotels, as they are and our other distinguished guests will accept The Madison in the way we think of it as a service, and we know that all you who understand the kind of the matter.

Donald F. Cooper
President

THE MADISON



Washington's Correct Address

NOTE: Our Madison Director has prepared a special information booklet for the Madison staff members. In this booklet information and the location of The Madison are detailed. If you wish like a copy of this information, please the search booklet, as this is being

in line and we will give these information your request. Information is available at the Madison Hotel, 1100 Pennsylvania Avenue, N.W., Washington, D. C.

ROLLS-ROYCE CUSTOMER SERVICE IN NORTH AMERICA



ALOHA
BONANZA
CANADIAN PACIFIC
CAPITOL
CONTINENTAL
FLYING TIGER
MARITIME CENTRAL
NOROAIR
NORTHEAST
NORTHERN CONSOLIDATED
OZARK
PACIFIC
PIEDMONT
QUEBECAIR
SEABOARD WORLD
SLICK
TRANS CANADA
UNITED
WEST COAST
WIEN ALASKA



These airlines and over 85 other operators fly more than 360 Rolls-Royce turbine powered transports throughout the United States and Canada.

Rolls-Royce turbofan, turbojet and turboprop engines are being overhauled at Dallas, Denver, Los Angeles, Millville N.J., San Francisco and Washington D.C. in the United States, and by Rolls-Royce of Canada and operators at Montreal and Winnipeg. More than 50 Rolls-Royce field service engineers are stationed with aircraft operators across the North American Continent.

ROLLS-ROYCE OF CANADA LIMITED, 4385 COTE DE LIESSE ROAD, MONTREAL, P Q
AERO ENGINES MOTOR CARS DIESEL & GASOLINE ENGINES ROCKET MOTORS NUCLEAR PROPULSION



ROOM AT THE TOP

This photo-optical space chamber—largest of its kind—simulates altitudes of 300 miles (4x10⁵ feet high). In this 3000 sq. ft. chamber, new infrared, TV and photographic sensory systems are performance tested as aerospace arrangements. Other types of equipment, even complete satellites and spacecraft, are also checked out here. Capabilities of the chamber include temperatures from -100° F to +300° F, and vibration of 38,000 lanes-pounds to 300,000 feet. A high resolution photo-optical test system beams the chamber features a collimator arm with a vertical focal length of 27 feet. Terrain motion is simulated with dynamic resolution targets.

For more details on the unique testing facility write for Brochure: "Facilities and Capabilities—An Eye to the Future." Address: Fairchild, Department 13, Robbins Lane, Syosset, N. Y.



DEFENSE PRODUCTS DIVISION
SYDNEY H. P. CLIFTON, N. Y.
101 ANGELES, CALIFORNIA 91301

A COMPLETE VISUAL IMAGING SYSTEMS CAPABILITY

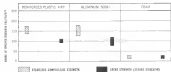


for Saturn S-II, S-IV,
Hexcel HRP[®] Honeycomb gives Saturn insulation plus highest strength-to-weight ratio!

*Heat Resistant Phenolic glass fabric reinforced plastic honeycomb, (lightest ever produced)

You don't have to sacrifice reliability or structural strength in tanks and bulkheads to get insulation performance! Hexcel's proven line of HRP honeycomb cores assures a superior combination of both strength and insulation. Chart below illustrates HRP compressive and shear strengths as compared to aluminum honeycomb and urethane foam.

PROPERTIES AT ROOM TEMPERATURE



Hexcel HRP has superior insulating properties along with structural strengths 2 to 10 times greater than conventional insulating materials. HRP's strength-to-weight ratio at room temperature is among the highest of any structural core material — and shows a starting 30% increase at -423°F. At this temperature the material has only a slight loss of toughness and damage resistance.

Consult with Hexcel Engineers — Experts in Structural Insulation from +355°F. to -423°F.

Hexcel can supply technical know-how to assist you in application of one of 18 HRP core types with a wide range of mechanical properties and densities from 1.6 to 15 pounds per cubic foot. Hexcel honeycomb can be supplied expanded, in sliced or block form, curved, curved or contoured to meet your needs. Technical Service Bulletin 112 available by contacting:



HEXCEL[®] PRODUCTS INC.

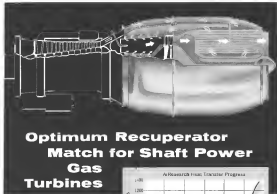
Division of General Electric Company

Executive Office: 2030 Fourth St., Berkeley, California

Plant: Industrial and Shipping Building

Plant: 4000 Meridian

Sales Offices: Inland Empire, California; New York, Texas; Hawaii and Other Markets



**Optimum Recuperator
 Match for Shaft Power
 Gas Turbines**

Garrett-AiResearch recuperators improve specific fuel consumption up to 40%, with minimum size and weight ratios and highest reliability

To be competitive, new military and industrial gas turbines will require optimum recuperator design and fabrication. Garrett-AiResearch experience in special heat transfer systems includes:

PRODUCTION

More than 600,000 heat transfer systems fabricated

ENVIRONMENT

Thermal stress: 1000°F differential across unit

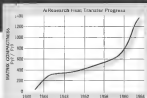
Vibration testing: 0 to 1500 cps, 150 G

Temperature range: -420 to 2800°F

Heat transfer fluids: liquid metals, oil, fuel, oil, gas, cryogenic fluids

RELIABILITY

AiResearch Seal boundary recuperators have an



newer parts, require minimum maintenance. More than 200,000 hours already accumulated on production heat recovery units.

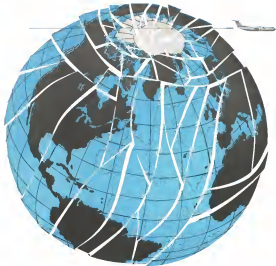
Garrett-AiResearch uses this experience in a recuperator optimization computer program to: (1) match all heat transfer parameters to engine manufacturer's requirements, (2) integrate gas turbine analysis, (3) select optimum design and material, and (4) fabricate reliable equipment.

Garrett-AiResearch is working on recuperator optimization programs with more than half the military and industrial gas turbine manufacturers in North America, and is fabricating and testing complex units. For further recuperator information, write to the AiResearch Manufacturing Division, Los Angeles.



AIRESEARCH[®] MANUFACTURING DIVISIONS • Los Angeles, California • Phoenix, Arizona
 Systems and Components for:
 Aircraft, Missiles, Spacecraft, Rocket Motors, Nuclear and Industrial Applications

Volume 76
Number 1



C-12 Gyrosyn® System Pulls It Together. Magnetic field phenomena—historic sources of major navigational error in aircraft compass systems—are canceled automatically in the new Sperry C-12 Gyrosyn Compass System. □ The C-12 is a gyro-magnetic system through and through. Designed expressly to meet the needs of the commercial operator, it approaches inertial systems in capability—at a fraction of the cost and complexity. Providing the extremely precise primary heading reference required for Doppler navigation, the C-12 achieves accuracy in flight within 0.25 degree, which is equivalent to 0.0044 mile-per-mile track-track error. It has been selected by UNAF for the new Lockheed C-141 Starliner jet transport. □ This new system, with its great potential for both civil and military aviation, exploits to the fullest Sperry's unparalleled experience in magnetism. Elements also can be incorporated in other Sperry compass equipment, notably the famed C-11 Gyrosyn system, to improve magnetic capability. Why not investigate with us now? SPERRY PHOENIX COMPANY, Phoenix, Arizona.

SPERRY

DIVISIONS OF
SPERRY RAND
CORPORATION

EDITORS NANCY W. Smith, Jr.
Robert S. May
MANAGING EDITOR William Grayson

ASSISTANT EDITORS
David Anderson, Editor, Aviation, East
Dick L. L. Baker, Editor, West Coast
TECHNICAL EDITOR Fred S. Anderson
EDITORIAL BOARD Carl Bruesch

BOARD CHIEFS
ENGINEERING Earl Cook
D.L. Lindley
AVIATION Fred S. Anderson
SPACE Robert S. May
OPERATIONS George Alexander

BOARD EDITORS
ISSUE EDITORS Arnold Strehme
E.H. Hines
ISSUE EDITORS Robert S. May
George Alexander
ASSOCIATE EDITORS Fred S. Anderson
Earl Cook
REVIEWERS James S. Anderson, Editor, Aviation
Earl Cook, Editor, Space
Robert S. May, Editor, Operations

SPACE TECHNOLOGY Edward G. Wilson
AVIATION EDITORS Larry Leake
MANAGEMENT EDITOR Albert Anderson
EDITORIAL BOARD Fred S. Anderson
Earl Cook
EDITORIAL BOARD George Alexander
Earl Cook
EDITORIAL BOARD Fred S. Anderson
Earl Cook
EDITORIAL BOARD Fred S. Anderson
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

EDITORIAL BOARD
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook
Fred S. Anderson
Earl Cook
George Alexander
Earl Cook

SPACE TECHNOLOGY
SPACE PROGRAM FACES SEVEREST CHALLENGE 26
U. S. Will Retain Technical Aid In Europe 27
Venus May Have Slow Retrograde 28
Van Allen His Nuclear Blast Report 29
Soviet Mars Probe Design Details Show 30
Booyah Rocket-Handling System Sketched 32
Growth Potential Seen For Icarus Jan. 2 33

AIR TRANSPORT
UNCERTAINTY SHADOWS PAN-AMERICAN-TWA MERGER ATTEMPT 38
Severe Excess Capacity on Aerojet Inflight 41
Anglo French SST In Have \$8.9 Billion U.S. Cost 42
Shoreline Arms Set For Top Common Market Role 44
Airline Income and Expenses—October, 1962 49
Airline Observer 52
Shortlines 52

AERONAUTICAL ENGINEERING
HIGH ALTITUDE HELICOPTER IS RATED VITAL INDIA NEED 26
Army Plan For 12 Helicopters in Vietnam 27
Power Boost Planned for STOL C-130 54
Production Briefing 57
New Aerospace Products 71

MISSILE ENGINEERING
LITTLE HOPE SEEN FOR SKYBOOTS SUBVANTAL 29
USAF, Pentagon Deal on Skybolt Test Date 29
Hard-Peak ICBM Defense Offering Pushed 34
Four SAC Cases Controlling Minuteman 52

AVIATION
POTENTIAL FAILURES DETECTED BY RF NOISE 76
Engle Deploy Radar at Indianapolis TAA Facility 47
New TV System Promotes Picture During Darkness 81
Niter Center 75
New Aviation Products 87

MANAGEMENT
PRESIDENT DISCUSSES DEFENSE PROGRAMS 91
Boeing Labor Stand Crumpled by Board 30
Industry Observer 73
What's Where 23

WORKING ROUNDUP 25
News Digest 37
Letters 118
Answers 118

EDITORIAL
Looking Ahead 21

COVER Capability for overhead tracking is stressed in the use of X-V, or double slipstream, mode for the Cape X-15's mission for the National Aerospace and Space Administration. Also common aerodynamic elements are depicted in most military designs meant for low angle tracking. The three dimensional perspective of solid state tracking system is designed for installation up to 18 degrees. Developed by Philco's Systems Development Laboratories for use in the Relay communications satellite program, the antenna is used in the Relay Space Near Earth, Earth Orbit. Other data will be sent by Relay from the Space Station Center of Operations and Air into Relay provided digital handling equipment for automatic routing. The mount provides full hemispherical coverage except for about 5 deg. above the horizon 25 deg. each side of the X-axis.

PHOTO CREDITS
Cover: Walter A. Sorenson; Photo Caps: 22, 23: Tom S. McLaughlin; 40: David Day; 4: Richard A. 40: William H. Sorenson; 41: Sorenson; 42: Sorenson; 44: Sorenson; 45: Sorenson; 46: Sorenson; 47: Sorenson; 48: Sorenson; 49: Sorenson; 50: Sorenson; 51: Sorenson; 52: Sorenson; 53: Sorenson; 54: Sorenson; 55: Sorenson; 56: Sorenson; 57: Sorenson; 58: Sorenson; 59: Sorenson; 60: Sorenson; 61: Sorenson; 62: Sorenson; 63: Sorenson; 64: Sorenson; 65: Sorenson; 66: Sorenson; 67: Sorenson; 68: Sorenson; 69: Sorenson; 70: Sorenson; 71: Sorenson; 72: Sorenson; 73: Sorenson; 74: Sorenson; 75: Sorenson; 76: Sorenson; 77: Sorenson; 78: Sorenson; 79: Sorenson; 80: Sorenson; 81: Sorenson; 82: Sorenson; 83: Sorenson; 84: Sorenson; 85: Sorenson; 86: Sorenson; 87: Sorenson; 88: Sorenson; 89: Sorenson; 90: Sorenson; 91: Sorenson; 92: Sorenson; 93: Sorenson; 94: Sorenson; 95: Sorenson; 96: Sorenson; 97: Sorenson; 98: Sorenson; 99: Sorenson; 100: Sorenson; 101: Sorenson; 102: Sorenson; 103: Sorenson; 104: Sorenson; 105: Sorenson; 106: Sorenson; 107: Sorenson; 108: Sorenson; 109: Sorenson; 110: Sorenson; 111: Sorenson; 112: Sorenson; 113: Sorenson; 114: Sorenson; 115: Sorenson; 116: Sorenson; 117: Sorenson; 118: Sorenson; 119: Sorenson; 120: Sorenson; 121: Sorenson; 122: Sorenson; 123: Sorenson; 124: Sorenson; 125: Sorenson; 126: Sorenson; 127: Sorenson; 128: Sorenson; 129: Sorenson; 130: Sorenson; 131: Sorenson; 132: Sorenson; 133: Sorenson; 134: Sorenson; 135: Sorenson; 136: Sorenson; 137: Sorenson; 138: Sorenson; 139: Sorenson; 140: Sorenson; 141: Sorenson; 142: Sorenson; 143: Sorenson; 144: Sorenson; 145: Sorenson; 146: Sorenson; 147: Sorenson; 148: Sorenson; 149: Sorenson; 150: Sorenson; 151: Sorenson; 152: Sorenson; 153: Sorenson; 154: Sorenson; 155: Sorenson; 156: Sorenson; 157: Sorenson; 158: Sorenson; 159: Sorenson; 160: Sorenson; 161: Sorenson; 162: Sorenson; 163: Sorenson; 164: Sorenson; 165: Sorenson; 166: Sorenson; 167: Sorenson; 168: Sorenson; 169: Sorenson; 170: Sorenson; 171: Sorenson; 172: Sorenson; 173: Sorenson; 174: Sorenson; 175: Sorenson; 176: Sorenson; 177: Sorenson; 178: Sorenson; 179: Sorenson; 180: Sorenson; 181: Sorenson; 182: Sorenson; 183: Sorenson; 184: Sorenson; 185: Sorenson; 186: Sorenson; 187: Sorenson; 188: Sorenson; 189: Sorenson; 190: Sorenson; 191: Sorenson; 192: Sorenson; 193: Sorenson; 194: Sorenson; 195: Sorenson; 196: Sorenson; 197: Sorenson; 198: Sorenson; 199: Sorenson; 200: Sorenson; 201: Sorenson; 202: Sorenson; 203: Sorenson; 204: Sorenson; 205: Sorenson; 206: Sorenson; 207: Sorenson; 208: Sorenson; 209: Sorenson; 210: Sorenson; 211: Sorenson; 212: Sorenson; 213: Sorenson; 214: Sorenson; 215: Sorenson; 216: Sorenson; 217: Sorenson; 218: Sorenson; 219: Sorenson; 220: Sorenson; 221: Sorenson; 222: Sorenson; 223: Sorenson; 224: Sorenson; 225: Sorenson; 226: Sorenson; 227: Sorenson; 228: Sorenson; 229: Sorenson; 230: Sorenson; 231: Sorenson; 232: Sorenson; 233: Sorenson; 234: Sorenson; 235: Sorenson; 236: Sorenson; 237: Sorenson; 238: Sorenson; 239: Sorenson; 240: Sorenson; 241: Sorenson; 242: Sorenson; 243: Sorenson; 244: Sorenson; 245: Sorenson; 246: Sorenson; 247: Sorenson; 248: Sorenson; 249: Sorenson; 250: Sorenson; 251: Sorenson; 252: Sorenson; 253: Sorenson; 254: Sorenson; 255: Sorenson; 256: Sorenson; 257: Sorenson; 258: Sorenson; 259: Sorenson; 260: Sorenson; 261: Sorenson; 262: Sorenson; 263: Sorenson; 264: Sorenson; 265: Sorenson; 266: Sorenson; 267: Sorenson; 268: Sorenson; 269: Sorenson; 270: Sorenson; 271: Sorenson; 272: Sorenson; 273: Sorenson; 274: Sorenson; 275: Sorenson; 276: Sorenson; 277: Sorenson; 278: Sorenson; 279: Sorenson; 280: Sorenson; 281: Sorenson; 282: Sorenson; 283: Sorenson; 284: Sorenson; 285: Sorenson; 286: Sorenson; 287: Sorenson; 288: Sorenson; 289: Sorenson; 290: Sorenson; 291: Sorenson; 292: Sorenson; 293: Sorenson; 294: Sorenson; 295: Sorenson; 296: Sorenson; 297: Sorenson; 298: Sorenson; 299: Sorenson; 300: Sorenson; 301: Sorenson; 302: Sorenson; 303: Sorenson; 304: Sorenson; 305: Sorenson; 306: Sorenson; 307: Sorenson; 308: Sorenson; 309: Sorenson; 310: Sorenson; 311: Sorenson; 312: Sorenson; 313: Sorenson; 314: Sorenson; 315: Sorenson; 316: Sorenson; 317: Sorenson; 318: Sorenson; 319: Sorenson; 320: Sorenson; 321: Sorenson; 322: Sorenson; 323: Sorenson; 324: Sorenson; 325: Sorenson; 326: Sorenson; 327: Sorenson; 328: Sorenson; 329: Sorenson; 330: Sorenson; 331: Sorenson; 332: Sorenson; 333: Sorenson; 334: Sorenson; 335: Sorenson; 336: Sorenson; 337: Sorenson; 338: Sorenson; 339: Sorenson; 340: Sorenson; 341: Sorenson; 342: Sorenson; 343: Sorenson; 344: Sorenson; 345: Sorenson; 346: Sorenson; 347: Sorenson; 348: Sorenson; 349: Sorenson; 350: Sorenson; 351: Sorenson; 352: Sorenson; 353: Sorenson; 354: Sorenson; 355: Sorenson; 356: Sorenson; 357: Sorenson; 358: Sorenson; 359: Sorenson; 360: Sorenson; 361: Sorenson; 362: Sorenson; 363: Sorenson; 364: Sorenson; 365: Sorenson; 366: Sorenson; 367: Sorenson; 368: Sorenson; 369: Sorenson; 370: Sorenson; 371: Sorenson; 372: Sorenson; 373: Sorenson; 374: Sorenson; 375: Sorenson; 376: Sorenson; 377: Sorenson; 378: Sorenson; 379: Sorenson; 380: Sorenson; 381: Sorenson; 382: Sorenson; 383: Sorenson; 384: Sorenson; 385: Sorenson; 386: Sorenson; 387: Sorenson; 388: Sorenson; 389: Sorenson; 390: Sorenson; 391: Sorenson; 392: Sorenson; 393: Sorenson; 394: Sorenson; 395: Sorenson; 396: Sorenson; 397: Sorenson; 398: Sorenson; 399: Sorenson; 400: Sorenson; 401: Sorenson; 402: Sorenson; 403: Sorenson; 404: Sorenson; 405: Sorenson; 406: Sorenson; 407: Sorenson; 408: Sorenson; 409: Sorenson; 410: Sorenson; 411: Sorenson; 412: Sorenson; 413: Sorenson; 414: Sorenson; 415: Sorenson; 416: Sorenson; 417: Sorenson; 418: Sorenson; 419: Sorenson; 420: Sorenson; 421: Sorenson; 422: Sorenson; 423: Sorenson; 424: Sorenson; 425: Sorenson; 426: Sorenson; 427: Sorenson; 428: Sorenson; 429: Sorenson; 430: Sorenson; 431: Sorenson; 432: Sorenson; 433: Sorenson; 434: Sorenson; 435: Sorenson; 436: Sorenson; 437: Sorenson; 438: Sorenson; 439: Sorenson; 440: Sorenson; 441: Sorenson; 442: Sorenson; 443: Sorenson; 444: Sorenson; 445: Sorenson; 446: Sorenson; 447: Sorenson; 448: Sorenson; 449: Sorenson; 450: Sorenson; 451: Sorenson; 452: Sorenson; 453: Sorenson; 454: Sorenson; 455: Sorenson; 456: Sorenson; 457: Sorenson; 458: Sorenson; 459: Sorenson; 460: Sorenson; 461: Sorenson; 462: Sorenson; 463: Sorenson; 464: Sorenson; 465: Sorenson; 466: Sorenson; 467: Sorenson; 468: Sorenson; 469: Sorenson; 470: Sorenson; 471: Sorenson; 472: Sorenson; 473: Sorenson; 474: Sorenson; 475: Sorenson; 476: Sorenson; 477: Sorenson; 478: Sorenson; 479: Sorenson; 480: Sorenson; 481: Sorenson; 482: Sorenson; 483: Sorenson; 484: Sorenson; 485: Sorenson; 486: Sorenson; 487: Sorenson; 488: Sorenson; 489: Sorenson; 490: Sorenson; 491: Sorenson; 492: Sorenson; 493: Sorenson; 494: Sorenson; 495: Sorenson; 496: Sorenson; 497: Sorenson; 498: Sorenson; 499: Sorenson; 500: Sorenson; 501: Sorenson; 502: Sorenson; 503: Sorenson; 504: Sorenson; 505: Sorenson; 506: Sorenson; 507: Sorenson; 508: Sorenson; 509: Sorenson; 510: Sorenson; 511: Sorenson; 512: Sorenson; 513: Sorenson; 514: Sorenson; 515: Sorenson; 516: Sorenson; 517: Sorenson; 518: Sorenson; 519: Sorenson; 520: Sorenson; 521: Sorenson; 522: Sorenson; 523: Sorenson; 524: Sorenson; 525: Sorenson; 526: Sorenson; 527: Sorenson; 528: Sorenson; 529: Sorenson; 530: Sorenson; 531: Sorenson; 532: Sorenson; 533: Sorenson; 534: Sorenson; 535: Sorenson; 536: Sorenson; 537: Sorenson; 538: Sorenson; 539: Sorenson; 540: Sorenson; 541: Sorenson; 542: Sorenson; 543: Sorenson; 544: Sorenson; 545: Sorenson; 546: Sorenson; 547: Sorenson; 548: Sorenson; 549: Sorenson; 550: Sorenson; 551: Sorenson; 552: Sorenson; 553: Sorenson; 554: Sorenson; 555: Sorenson; 556: Sorenson; 557: Sorenson; 558: Sorenson; 559: Sorenson; 560: Sorenson; 561: Sorenson; 562: Sorenson; 563: Sorenson; 564: Sorenson; 565: Sorenson; 566: Sorenson; 567: Sorenson; 568: Sorenson; 569: Sorenson; 570: Sorenson; 571: Sorenson; 572: Sorenson; 573: Sorenson; 574: Sorenson; 575: Sorenson; 576: Sorenson; 577: Sorenson; 578: Sorenson; 579: Sorenson; 580: Sorenson; 581: Sorenson; 582: Sorenson; 583: Sorenson; 584: Sorenson; 585: Sorenson; 586: Sorenson; 587: Sorenson; 588: Sorenson; 589: Sorenson; 590: Sorenson; 591: Sorenson; 592: Sorenson; 593: Sorenson; 594: Sorenson; 595: Sorenson; 596: Sorenson; 597: Sorenson; 598: Sorenson; 599: Sorenson; 600: Sorenson; 601: Sorenson; 602: Sorenson; 603: Sorenson; 604: Sorenson; 605: Sorenson; 606: Sorenson; 607: Sorenson; 608: Sorenson; 609: Sorenson; 610: Sorenson; 611: Sorenson; 612: Sorenson; 613: Sorenson; 614: Sorenson; 615: Sorenson; 616: Sorenson; 617: Sorenson; 618: Sorenson; 619: Sorenson; 620: Sorenson; 621: Sorenson; 622: Sorenson; 623: Sorenson; 624: Sorenson; 625: Sorenson; 626: Sorenson; 627: Sorenson; 628: Sorenson; 629: Sorenson; 630: Sorenson; 631: Sorenson; 632: Sorenson; 633: Sorenson; 634: Sorenson; 635: Sorenson; 636: Sorenson; 637: Sorenson; 638: Sorenson; 639: Sorenson; 640: Sorenson; 641: Sorenson; 642: Sorenson; 643: Sorenson; 644: Sorenson; 645: Sorenson; 646: Sorenson; 647: Sorenson; 648: Sorenson; 649: Sorenson; 650: Sorenson; 651: Sorenson; 652: Sorenson; 653: Sorenson; 654: Sorenson; 655: Sorenson; 656: Sorenson; 657: Sorenson; 658: Sorenson; 659: Sorenson; 660: Sorenson; 661: Sorenson; 662: Sorenson; 663: Sorenson; 664: Sorenson; 665: Sorenson; 666: Sorenson; 667: Sorenson; 668: Sorenson; 669: Sorenson; 670: Sorenson; 671: Sorenson; 672: Sorenson; 673: Sorenson; 674: Sorenson; 675: Sorenson; 676: Sorenson; 677: Sorenson; 678: Sorenson; 679: Sorenson; 680: Sorenson; 681: Sorenson; 682: Sorenson; 683: Sorenson; 684: Sorenson; 685: Sorenson; 686: Sorenson; 687: Sorenson; 688: Sorenson; 689: Sorenson; 690: Sorenson; 691: Sorenson; 692: Sorenson; 693: Sorenson; 694: Sorenson; 695: Sorenson; 696: Sorenson; 697: Sorenson; 698: Sorenson; 699: Sorenson; 700: Sorenson; 701: Sorenson; 702: Sorenson; 703: Sorenson; 704: Sorenson; 705: Sorenson; 706: Sorenson; 707: Sorenson; 708: Sorenson; 709: Sorenson; 710: Sorenson; 711: Sorenson; 712: Sorenson; 713: Sorenson; 714: Sorenson; 715: Sorenson; 716: Sorenson; 717: Sorenson; 718: Sorenson; 719: Sorenson; 720: Sorenson; 721: Sorenson; 722: Sorenson; 723: Sorenson; 724: Sorenson; 725: Sorenson; 726: Sorenson; 727: Sorenson; 728: Sorenson; 729: Sorenson; 730: Sorenson; 731: Sorenson; 732: Sorenson; 733: Sorenson; 734: Sorenson; 735: Sorenson; 736: Sorenson; 737: Sorenson; 738: Sorenson; 739: Sorenson; 740: Sorenson; 741: Sorenson; 742: Sorenson; 743: Sorenson; 744: Sorenson; 745: Sorenson; 746: Sorenson; 747: Sorenson; 748: Sorenson; 749: Sorenson; 750: Sorenson; 751: Sorenson; 752: Sorenson; 753: Sorenson; 754: Sorenson; 755: Sorenson; 756: Sorenson; 757: Sorenson; 758: Sorenson; 759: Sorenson; 760: Sorenson; 761: Sorenson; 762: Sorenson; 763: Sorenson; 764: Sorenson; 765: Sorenson; 766: Sorenson; 767: Sorenson; 768: Sorenson; 769: Sorenson; 770: Sorenson; 771: Sorenson; 772: Sorenson; 773: Sorenson; 774: Sorenson; 775: Sorenson; 776: Sorenson; 777: Sorenson; 778: Sorenson; 779: Sorenson; 780: Sorenson; 781: Sorenson; 782: Sorenson; 783: Sorenson; 784: Sorenson; 785: Sorenson; 786: Sorenson; 787: Sorenson; 788: Sorenson; 789: Sorenson; 790: Sorenson; 791: Sorenson; 792: Sorenson; 793: Sorenson; 794: Sorenson; 795: Sorenson; 796: Sorenson; 797: Sorenson; 798: Sorenson; 799: Sorenson; 800: Sorenson; 801: Sorenson; 802: Sorenson; 803: Sorenson; 804: Sorenson; 805: Sorenson; 806: Sorenson; 807: Sorenson; 808: Sorenson; 809: Sorenson; 810: Sorenson; 811: Sorenson; 812: Sorenson; 813: Sorenson; 814: Sorenson; 815: Sorenson; 816: Sorenson; 817: Sorenson; 818: Sorenson; 819: Sorenson; 820: Sorenson; 821: Sorenson; 822: Sorenson; 823: Sorenson; 824: Sorenson; 825: Sorenson; 826: Sorenson; 827: Sorenson; 828: Sorenson; 829: Sorenson; 830: Sorenson; 831: Sorenson; 832: Sorenson; 833: Sorenson; 834: Sorenson; 835: Sorenson; 836: Sorenson; 837: Sorenson; 838: Sorenson; 839: Sorenson; 840: Sorenson; 841: Sorenson; 842: Sorenson; 843: Sorenson; 844: Sorenson; 845: Sorenson; 846: Sorenson; 847: Sorenson; 848: Sorenson; 849: Sorenson; 850: Sorenson; 851: Sorenson; 852: Sorenson; 853: Sorenson; 854: Sorenson; 855: Sorenson; 856: Sorenson; 857: Sorenson; 858: Sorenson; 859: Sorenson; 860: Sorenson; 861: Sorenson; 862: Sorenson; 863: Sorenson; 864: Sorenson; 865: Sorenson; 866: Sorenson; 867: Sorenson; 868: Sorenson; 869: Sorenson; 870: Sorenson; 871: Sorenson; 872: Sorenson; 873: Sorenson; 874: Sorenson; 875: Sorenson; 876: Sorenson; 877: Sorenson; 878: Sorenson; 879: Sorenson; 880: Sorenson; 881: Sorenson; 882: Sorenson; 883: Sorenson; 884: Sorenson; 885: Sorenson; 886: Sorenson; 887: Sorenson; 888: Sorenson; 889: Sorenson; 890: Sorenson; 891: Sorenson; 892: Sorenson; 893: Sorenson; 894: Sorenson; 895: Sorenson; 896: Sorenson; 897: Sorenson; 898: Sorenson; 899: Sorenson; 900: Sorenson; 901: Sorenson; 902: Sorenson; 903: Sorenson; 904: Sorenson; 905: Sorenson; 906: Sorenson; 907: Sorenson; 908: Sorenson; 909: Sorenson; 910: Sorenson; 911: Sorenson; 912: Sorenson; 913: Sorenson; 914: Sorenson; 915: Sorenson; 916: Sorenson; 917: Sorenson; 918: Sorenson; 919: Sorenson; 920: Sorenson; 921: Sorenson; 922: Sorenson; 923: Sorenson; 924: Sorenson; 925: Sorenson; 926: Sorenson; 927: Sorenson; 928: Sorenson; 929: Sorenson; 930: Sorenson; 931: Sorenson; 932: Sorenson; 933: Sorenson; 934: Sorenson; 935: Sorenson; 936: Sorenson; 937: Sorenson; 938: Sorenson; 939: Sorenson; 940: Sorenson; 941: Sorenson; 942: Sorenson; 943: Sorenson; 944: Sorenson; 945: Sorenson; 946: Sorenson; 947: Sorenson; 948: Sorenson; 949: Sorenson; 950: Sorenson; 951: Sorenson; 952: Sorenson; 953: Sorenson; 954: Sorenson; 955: Sorenson; 956: Sorenson; 957: Sorenson; 958: Sorenson; 959: Sorenson; 960: Sorenson; 961: Sorenson; 962: Sorenson; 963: Sorenson; 964: Sorenson; 965: Sorenson; 966: Sorenson; 967: Sorenson; 968: Sorenson; 969: Sorenson; 970: Sorenson; 971: Sorenson; 972: Sorenson; 973: Sorenson; 974: Sorenson; 975: Sorenson; 976: Sorenson; 977: Sorenson; 978: Sorenson; 979: Sorenson; 980: Sorenson; 981: Sorenson; 982: Sorenson; 983: Sorenson; 984: Sorenson; 985: Sorenson; 986: Sorenson; 987: Sorenson; 988: Sorenson; 989: Sorenson; 990: Sorenson; 991: Sorenson; 992: Sorenson; 993: Sorenson; 994: Sorenson; 995: Sorenson; 996: Sorenson; 997: Sorenson; 998: Sorenson; 999: Sorenson; 1000: Sorenson.

Looking Ahead

The year ahead promises to be lively in the aerospace business, with an extra large dash of political spice added to the recipe of galloping technology, mixed with some gray and management problems that have become dark and indistinct in recent years.

Fundamental to all aerospace activity in 1965 is the simple fact that this will be the period when the basic foundations will be laid for the 1964 presidential election campaign. Everything that happens during the next 12 months in Washington will be measured toward that goal. Thus we have the odd spectacle of an Administration pushing higher expenditures for space and defense on one hand and trying to squeeze the tax cuts in its legislative program. The game here is not to see who will really get a tax cut but to see who gets the credit of not letting the voters have the tax cut they so eagerly seek, and who gets the credit for trying to give it to them while still not losing any cash from the federal treasury. This is why things are not always best when they seem best.

The Kennedy Administration at mid-time is facing a financial and political reckoning all along the New Frontier as the happy programs and bright glimmers with which it was attracted in the aerospace field, it will have to decide which ones can just live but not be expected to pay for the money just has had a reasonable exploration of space we will make and how strong a defense force we will build for the future.

The most critical area of its transition from safety to self-reliance is facing the national space program (see p. 26). A more realistic view of the costs for the manned lunar landing program is now possible than at the time President Kennedy made his bold commitment in this area. Of course these costs are being set in the program progress. They dictate either a large increase in the overall space budget, a larger share of the space funds committed for manned flight or reducing the technical pace to fit budget structures. Congress which has given unprecedented and unprecedented support to the space program during the past few years, is growing more critical and less enthusiastic over the strong space budget and the character of its program. NASA leaders will find the details as Capitol Hill considerably different than they are and they should well disappointed legislative efforts will be put to it in no time flat. This will get less support this year, too, from the great series of space achievements that held the public spotlight during 1962, from the Mercury astronaut flight to Titan. The bold space achievements of 1963 will be made in the more private atmosphere of the blunderous, experimental machine shops and experimental test rigs as the first proof of technical feasibility is translated into reliable operational systems. This for more important work is less likely to impress either Congress or the American public than the metal finished demonstration, and now create a fair impression of a technical bill unless some formal and careful explanation are forthcoming by NASA.

There is certain to be serious questioning not only of the rising level of space expenditures but also of the character of the NASA program with its current 75%

emphasis on manned space flight. There is growing pressure for more emphasis on space science and a broader orientation than the Apollo program apparently offers. This pressure will increase in direct proportion to the NASA budget squeeze in competition for the available dollar gets tighter string programs. Personnel debate over the military role in space will probably shake out this year as the result of increasing space expenditures with out more definite relation to military applications is questioned by the changing character of congressional space legislation.

The Fiscal 1964 defense budget presents the same old problem of trying to squeeze all of the requirements to sustain adequate military forces to bring into the research and development sections for new weapon systems, into what ever administration hopefully believes will be a stable budget level. In the wrong year of the Eisenhower Administration, the defense budget was stabilized at about \$40 billion. In the first years of the Kennedy Administration the talk was of stabilizing the defense budget at \$50 billion for a five year period. But already the \$50 billion level has sadly slipped into history in the face of inflation unanticipated intense fiscal cuts and expanding requirements and constant threats.

As shown when executive officials are faced with the dilemma, they seek the solution in chopping weapon system programs. When all the faster over Silyth satellite (see p. 29), it will be apparent that this was primarily a fiscal device designed to lay off \$2 billion from the next few budgets when the weapon costs would have ballooned from the satellite small errors development led to a substantial production bill. All of the leased tail over technical difficulties was simply obfuscation.

The Kennedy Administration has made a very significant decision in the B-52 bomber fleet equipped with Hard Dog missiles, and the Atlas, Titan, Minuteman and Polaris ballistic missile programs. For the immediate future it is betting heavily on Minuteman and Polaris to bolster the deterrent and the McDonnell F-4B tactical fighter and Lockheed C-141 jet transport to strengthen limited war capability.

New weapon system programs beyond the area are being a still further well demonstrated program cost estimation is also being by, as Administration conviction that the world has needed a platform of technical development in weapon system and it is now possible to cry a "technical breathing spell" that allows for less very over-optimism of an new development focus. They believe also that the budget gaps that result from hard pressing the state of the art, as in the KRM program.

This feeling of a "technical breathing spell" is a recurrent symptom of complacent ignorance. It was a policy of many nations in the period just before their breakdown by less intelligent businessmen who were not sufficiently sophisticated to perceive their shortcomings. It has always proved to be an illusion, but if it were that a little applied to find it during such wide acceptance only five years after Sputnik should have wiped away these clouds for the generation.

—Robert Thax



We put 140 gallons in a 14-gallon bag!

This collapsible tank is made of a remarkable new RFG Goodrich material called Estane®. That's why, although the tank has a design capacity of 14 gallons, it took more than ten times that much fluid before it burst. Even then the electrically welded seams remained intact.

RFG Estane® can be custom designed to fit circular enclosures, to connect to both air and liquid systems, to hold gases, liquids, acids and acids.

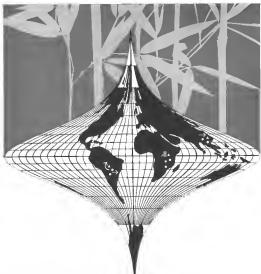
Estane, they can be customarily fabricated, yet have very high tensile strength at high ultimate elongation. Estane has excellent resistance to oil, fuels, various chemicals, and more. It withstands continuous operating temperatures as high as 200°F, retains flexibility as low as -60°F.

RFG also offers a line of standard collapsible enclosures for bulk storage, called "Storotanks." These permit bulk storage of many hydrocarbons and some corrosive liquids and slurries at far less cost than metal tanks or rigid enclosures. For complete information on Estane® and Storotanks, write RFG Goodrich Aerospace and Defense Products, a division of The RFG Goodrich Company, Department 111 J, Akron, Ohio.

RFG Goodrich
aerospace and
defense products

3000 gallon
"Storotank"
for bulk
storage of fuels





ENGINEERED FOR GLOBAL STREET FIGHTING

MODICON™ V - ready to move on instant notice to anywhere in the world to counter aggression on enemy-selected ground and under enemy-prescribed conditions. Designed to assure mastery of the air situation with command and control of aerial operations and close support of ground forces. Engineered for first day capability, mixed weapons control, modular interoperability. Compactly packaged for global mobility in air-transportable shelters suitable for helicopter and vehicular operations. Fully researched and developed for rapid integration into special air warfare units/Regiments and scientists qualified to assume important assignments in advanced data handling and display systems will find a broad spectrum of challenging opportunities at Lattice Systems. Complete information on openings may be obtained by submitting resume to Professional Employment Manager, 4700 Eton Avenue, Canoga Park, California. An Equal Opportunity Employer. *MODular Dispersed Control

ILLITTON SYSTEMS, INC./DATA SYSTEMS DIVISION A Division of Lattice Industries

WHO'S WHERE

In the Front Office

George Kirk, executive vice president general manager, United Aircraft and Astronautics, **M. DeVos**, executive vice president executive planning.

Dr. Linn W. Adams, of the University of California Radiation Laboratory, chaired a study of Allied Research Associates Inc., General Mills.

May Gene Albert Boyd (DIAF) has resigned as vice president of Westinghouse Electric Corp.

E. D. W. Cooke, vice president, general manager and director of all U.S. operations, **John D. Mitchell**, executive vice president, **James Wood** who resigns to be employed by a new petroleum firm, **John H. Smith, III**, **Gene Franklin H. Smith, Jr.**, (DIAF) vice president and executive assistant to the president of Republic Aviation Corp., Farmingdale, N. Y.

Donald M. Wade, vice president Europe for the F-111 program for Lockheed-California Co. with headquarters in Kibben, Germany.

Dr. Isaac C. Richter, vice president advanced systems of Aero-General Corp., Aero-Craft, Inc. Richter continues to be president of Aero-General Corp., a subsidiary.

Ger. Ch. D. Hoffmann (DIA), et al. is president, United Mach Corp., St. Louis, Mo.

H. Eric Dealy, president, Control Systems Corp., Alexandria, Va.

Malcolm D. Kim has resigned the position of Aero-General Corp. Having been with the corporation of the following officers: **Norman Lee Ray, M.D.**, health insurance and director of research, **Mr. Kim**, president and general manager, **Raymond W. Fox**, vice president and director of technical operations, **Donald L. Fisher**, administrative and head of the Propulsion Department.

Edward L. King, president and chief executive officer of Magna Inc., Morris Plains, N. J.

Dr. William M. DeLo, general manager & vice president for International Telephones and Telegraph Corp., he continues as president of ITT Federal Laboratories, Northridge, N. Y. **Mr. George A. Brown**, executive vice president of ITT Federal Laboratories, he continues as director president of ITT Kellogg Communications Systems.

Col. Harold V. Hiltgen, commander of the Aerospace Medical Division, School of Aerospace Medicine, Brooks AFB, Tex., he resigns. **Col. Paul A. Campbell** retired.

Honors and Elections

J. D. Pomeroy (AIAA) executive and deputy chairman of Ball-Bearings, Inc., has been named a Distinguished Engineer by General Motors. He is recognized in recognition of his outstanding technical and scientific work.

Robert H. Jensen of Douglas Aircraft and Space Division, has been elected president of the Aerospace Electrical Society for 1953.

(Continued on page 104)

INDUSTRY OBSERVER

► Thermodynamic problems of aerospace plane concepts will be investigated in a program of theoretical and experimental research planned by Air Force's Aeronautical Systems Division. Among subjects for study: effects of fuel stack on structure; fueling loads of high angles of attack; and backslapping divergence.

► Problems of graphite erosion in nozzles of Polaris first inflatable canister are bothering Navy technical personnel. Higher-density graphite is being suggested as a primary solution to minimize the problem.

► Three-pass ducted jet engine system is used in Ramjet system of the X-15 jet, claims Bell Helicopter and Ford subsidiaries. Second, larger stage is employed by hydrogen ducts and breaks the engine. An alternative also is 20,000 ft., the third and largest peroxide stage. At this point the conventional engine has oxygen separator and abandons the peroxide, using its peroxide products.

► Industry study effort for an over-all analysis of human engineering requirements related to spacecraft maintenance and repair is expected to be initiated soon by National Aeronautics and Space Administration. Results of the study probably will be compiled in a handbook.

► Proposals for advancing nozzle design and thrust-vector control by using large propellant tanks and solid propellant motor are submitted last week in Edwards AFB. They include major research objectives. Facilities proposals in competition for these applied research studies are now being evaluated by the Edwards group.

► Part of two packages of the Lockheed S-300 twin-jet trainer now under construction is scheduled to begin flight tests early in July. Both packages are being built with production tooling. If the aircraft meets performance specifications, Royal Swedish Air Force has ordered S-300 to be a total sum of 110 trainers.

► Army Missile Command is preparing a study for high resolution airborne radar techniques. Industry proposals were submitted last week to Army's Signal Support Agency, Ft. Monmouth, N. J., for a study.

► National Weather Research Center has received a Navy proposal to develop a single, three-dimensional weather satellite and currently is performing analytical studies on the system. Concept has been called ORLWS, for Direct Readout Operational Weather Satellite, and DRWS, for Direct Readout Satellite.

► Predictive coatings for repairable vehicles recovering from space will be investigated in a research program expected to be initiated by Air Force's Aeronautical Systems Division. Industry proposals were submitted in mid-December and now are being evaluated.

► Proposals for an information management system for Aerospace Medical Research Laboratories will be evaluated by Air Force Systems Command's Aeronautical Systems Division. Technical aspects of system were submitted by industry bidders last week. Details on costs are due next week.

► Simplification of landing extraction is the last phase of a new plan expected to be initiated by National Aeronautics and Space Administration. Plus will coordinate various experiments for sub-optimal rocket motors used by various NASA research and development studies.

► Evaluation procedures for materials suitable for uncooled rocket nozzles and gas control systems of rocket motors using high-energy liquid or solid propellants were submitted last week by industry to Air Force's Aeronautical Systems Division.



Melting columbite and tantalum in the 6000-deg. F interior of an electron beam furnace—a part of the advanced metals technology produced at Haynes Stellite. These metals and others—produced by the latest techniques—give you the tools to solve problems even at temperatures of 2300 deg. F and higher.

New metals and new methods—for problems at 2500° F

Melting columbite and tantalum—in the 6000-deg. F interior of an electron beam furnace—a part of the advanced metals technology produced at Haynes Stellite. These metals and others—produced by the latest techniques—give you the tools to solve problems even at temperatures of 2300 deg. F and higher.

Haynes nickel- and cobalt-base alloys and refractory metals are made to live longer at temperatures that would weaken and destroy ordinary metals. And they are available in the forms you need—from sheet and bar to investment castings—round- or air-melted. Ready to combat high temperatures in applications that may be causing you trouble.

Outline your problem and write to Haynes Stellite Company, 270 Park Avenue, New York 17, New York.

HAYNES
ALLOYS

HAYNES STELLITE COMPANY

Division of
Union Carbide Corporation
Kalamazoo, Indiana

**UNION
CARBIDE**

"Haynes" and "Union Carbide" are
registered trademarks of Union Carbide Corporation.

Washington Roundup

Nuclear Space Problems

U.S. policy on the development of nuclear energy for space vehicles and nuclear reactors is crucial to the future of the program and the probability is that the Kennedy Administration will be called on to revise its present direction.

Issues will range from President Kennedy's planned reorganization of the Atomic Energy Commission into a department, rather than an independent agency, to the question of whether Air Force should be authorized to develop a nuclear-powered, space-worthy low-altitude vehicle (SLV).

Industrial congressmen already have criticized the Administration for placing too little emphasis on nuclear reactors (see p. 36) and Sasep auxiliary power systems. This attack will intensify, with the leader parties coming from nuclear-oriented lawmakers from California and New Mexico.

The crux, in the Kennedy Administration's view, is whether nuclear technology is far enough advanced to warrant commitment to full-scale spending. The Administration, influenced by Dr. White House and Defense Dept. scientific advisers, feels it is not, in most cases. Yet there is a political limit to the number of times the Executive Branch can refuse to spend money appropriated by an annual Congress. Therefore, more studies—rather than outright cancellations—are expected in the nuclear power field. This is likely to be the Administration's approach toward Sasep, Nevada and Sasep/Spur.

After months of weighing, Defense Dept. and AEC officials have established the program office for Sasep-50/Spur under USAF Col. Edward M. Doerflinger. The power unit will be designed to generate 300 to 1,000 kw and have a weight of 10 to 20 lb./kw. Air Force estimates Sasep 50 Spur will fly within 6 to 10 years and cost about \$270 million up to the first flight test. Air Force-AEC funding responsibility for the project still is being discussed.

Soviet Air Strategy

Anti-subject theories have become the basic form of weapons for Russian analysts. Soviet Chief Marshal of Aviation Konstantin Verbitskiy said in a review of the role of aviation in modern war. Despite the fact that the "genetic code" of a future war belongs to long range, ground-based missiles if it is the cornerstone of Soviet military doctrine that victory will come only through intercontinental use of all kinds of the systems. Verbitskiy said. The Soviet air force chief also said his single operation of any size in a future war is thinkable without the participation of a large number of different forms and branches of aviation.

Verbitskiy said the rocket-carrying aircraft has come to replace the bomber and can strike not only stationary but moving land and sea targets from a high stage. He also said the ceiling of supersonic aircraft has risen to 98,000 ft and more.

Primary reason for the electronic advanced ballistic missile system (ABRES) flight program (AW Dec. 16, p. 27), which is to be begun this month, is that tests of dummy and other penetration aids in air have produced very disappointing results in their attempts to confuse defense systems (see p. 34).

Longer Mercury Flight

Possibility still exists for a three-day or two-day manned Mercury flight to fill the gap between the current Mercury program and the first Gemini flight. NASA has asked McDonnell to see what life support equipment could be added to the capsule and how solid Coreair Engines to check. Also asked important using a variety of weights.

Cost overruns on the conventional USAF-North American B-57D monomonostratic aircraft have prompted Defense Secretary Robert McNamara to caution Air Force to sleep down on spending.

Air Force headquarters is becoming disenchanted with the performance of Mitr Corp., technical advisers to its Electronic Systems Division, and is considering a cut back in funding for the nonprofit corporation. Some of the work formerly done by Mitr would be given to USAF organizations such as the Basic Air Development Center.

'Poor Cousins' Review

First thing Chairman George P. Miller of the House space committee wants to explore after NASA budget hearings are completed is what the agency is doing in its cash accounts. Rep. Miller felt "it's time that we go into it." The chairman got daughter Josephine has been getting all the spotlight. Let's take a look at some of their past years' work and see how it has fared and better business. He also wants to investigate the U. S. is doing in its overseas and industrial cooperation with other nations.

Space Communications Corp. has been selected as the winner for the manufacturing that satellite corporation being formed by 13 states named by the President. At this last meeting the incorporators also discussed USAF Gen. Lewis Norstad as a prospective chief executive officer, in view of his statement that he was not interested (AW Dec. 24, p. 33).

—Washington Staff

Van Allen Hits Nuclear Blast Report

President's Scientific Advisory Commission's handling of information relating to the July 9 Project Starfish high altitude nuclear blast has drawn criticism from two scientists who participated in the test.

Dr. James A. Van Allen, physics professor of the State University of Iowa and director of the center's radiation belt, said that the committee created an unreasonable false impression in the press by publishing of a report which inaccurately stated that the artificial satellite in the blast was the first ever to be struck near its nose and legs but that had been anticipated—and the report has no scientific basis attached.

Van Allen's criticism was voiced during his discussion of Project Starfish at the recent meeting of the American Association for the Advancement of Science in Philadelphia. It drew from the fact that the committee classified its pre-blast predictions and then explained the results obtained from the August and February 14 satellites which he said were in close agreement with the predictions.

Van Allen repeated his prediction that the dose rate of the critical belt would have three virtually undetectable to east-westward (JAW No. 10 1962 p. 26).

The committee headed by Dr. James B. Weaver, head of its report on data obtained from satellite Van Allen told Cosmos Space Flight Magazine that the committee's worst conclusion resulted from a "gross misinterpretation" of the data, other than an error in the data. "False results were assuming the satellite entered radiation belts and 'The committee incorrectly glibbed the whole business,' he said and told the world that 'we don't know what we're doing.'

Moreover, the report was released without warning several days before the Sept 11th conclusion of the Gemini Space Flight Center which was scheduled to resolve conflicting opinions on a side of the blast.

Van Allen criticized the committee's action to prevent from governmental bodies of its rapid release of scientific findings. In the several times that he has been asked if he said that he felt "embarrassed" by this "gross misinterpretation."

"It is an ethical position, as well as a scientific one, suggesting a moral judgment," he said, but stressed the fact that he spoke only as chairman in the committee meeting and did not wish his records to be confused with a sweeping condemnation of the committee's performance as it acts.

Dr. James W. Worek, a radio astronomer at the University of Colorado shared the criticism. He agreed with Van Allen's charges, and said that when he had tried to derive the results of his radio measurements of the artificial belts, a blank news conference with Van Allen's conclusions in full as he saw "nothing in his address."

The artificial radiation belts he had entered with radio emissions, such as observations at van der Waerden's contacts in gamma-rayed lines that satellite measurements would be necessary, applied on a long period of time.

Van Allen added that the President's committee had no access toward the extended scope of all other reports when it presented itself in "break what the scientific facts were." In order to construct a realistic assessment as was before the test, he suggested that as of late committee from the National Academy of Sciences be created. This committee would examine forthcoming tests, publish the statistical predictions and eventually analyze the results of data before releasing any results.

Research Center The Implications

was made by Marsch's observations. • Energetic Particles—An Atlas 213 Gagarin counter on Mariner detected only a single charged particle per second at the closest approach to Venus, compared with the several thousand per second measured over the same distance as known to indicate 20,000 ions from earth. The elevated ionometer rate did not differ from the ionospheric rate observed by Mariner during its October

Low Intensity

The indicates that the magnetic field which would trap particles does not extend as far as the Mariner trajectory, a point confirmed by the magnetometer. The low intensity and extent of the field, according to JPL, is believed due to the planet's slow rotation rate.

An artificial chamber measured a rate of ionization of 170 ion pairs per cubic centimeter per second throughout the flight and a Gagarin counter indicated a count rate of about three particles per square cm counter per second over the flight path, a situation which is expected as well to knowledge about the solar radiation.

Reports on these experiments were made by Dr. Hugh R. Anderson, JPL, and Les A. Frank, from State University of Iowa. They colleagues on the Mars magnetic, magnetometer, and Dr. H. V. Nelso, Galileo, and Dr. James A. Van Allen, ions.

• Solar plasma—Solar plasma or solar wind—stream of hot ionized gases appears constantly from the sun, consists of the sun's outer atmosphere, and is believed to be a Mariner experiment over long periods

of time and results described by Dr. Gregory W. Swider for Mrs. Marsha Neugebauer, also of JPL, and herself.

The solar wind appears to be blowing constantly and has collected energy to drag or push aside magnetic fields. The top of the individual gas atoms in the wind is low, but they are so dense compared with atoms in particles that the total energy content of the plasma is greater than those ions and neutrons in the plasma can produce noticeable effects on earth.

From the findings of an electronic instrument which measured particles near the earth, levels, the velocity of the solar wind was found to be less than 230 mi. sec. During relatively quiet conditions its temperature is about 200,000K and particle density is around 10 to 70 per cubic centimeter.

The wind drags up solar disturbances or ionized solar flares, great clouds of plasma, the temperature, densities and velocity of which may exceed those observed in more quiet periods, possibly making it appear that solar wind is blowing harder than usual. Examples of these less quietness appearance were observed by Mariner. Highest mean solar wind current was 0.4 milliamperes. Mariner also measured magnetic field of the mass of Venus 0.3185 times that of earth with a probable error of 0.0358. This was made by preliminary analysis of spacecraft trajectory data obtained during Mariner flight, according to John D. Anderson and George Noll of JPL.

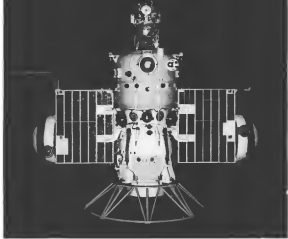
Now for the estimate was a comparison of a Goldstone-transmitted signal with a spacecraft transmitted frequency, transmitted signal from which spacecraft velocity with respect to the earth was derived. A change in the velocity due to the gravitational field of Venus provided the basis for calculating mass, which in reference to the determined mass of other solar bodies.

• Cosmic dust—Mariner's instruments that detectors indicated one unexplained encounter with a cosmic particle, and there were other particles, according to W. M. Alexander, Goddard Space Flight Center, reported to the following.

New Cosmos Satellite Orbiting by Russians

Moscow—Soviet Union launched the 12th satellite in the Cosmos Series Oct. 21. The Russian news agency Tass later said that the satellite was functioning normally.

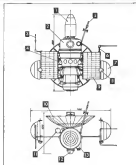
Cosmos 12 has an orbit ranging from 251.1 mi. to 1165.8 mi., with a period of 96.45 min. Inclination is 65 deg. Cosmos 12 is transmitting on a frequency of 18,495 mc., according to Tass.



Soviet Mars Probe Design Details Shown

Soviet interplanetary probe Mars 1 carries roughly twice as many U.S. satellites and space probes with solar panels extending on either side of a central body, above. Instruments view right, show (1) scanning engine in forward position, (2) solar panel components, (3) and (4) on solar panel, (5) solar panel, (6) solar panel, (7) thermal radiation system, (8) low gain directional antenna, (9) solar battery panel, (10) light-gate directional antenna, (11) spectro-electronics, (12) pressure and solar concentration data unit, and (13) constant solar concentration data unit. Details on that according to correct data the probe probe was located at about distance 6 deg. 27 min., declination 99 deg. 32 min. and was a distance of 24,227,000 km from earth on Jan. 2.

Soviet probe was launched Nov. 2 (AW Nov. 5, p. 45) and is expected to pass Mars about mid-May.



Hard Point ICBM Defense Effort Pushed

By Philip J. Klass

Washington—Programs to investigate the technical feasibility of a simple, low cost ICBM defense system specifically designed to protect hardened underground missile sites and vital command centers is getting increased Defense Dept emphasis.

The hard point defense concept centers on anti-ICBM missile intercept systems or anti-ICBM missile intercept vehicles—satellite Nike Zeus—radio adaptable to hardened existing and future sites. The intercept vehicles would have extremely high maneuverability and maneuverability, but such vehicles' short range. Intercept might occur at altitudes of 10,000 mi., perhaps even lower.

The concept is not a direct competitor to the Nike Zeus which is being upgraded to provide two defense against ICBM attack. Nor should it be confused with Area's Sprint program currently in the study phase in which the use of smaller high acceleration missiles at a low altitude supplemented in the long range, Zeus is being considered (AV Dec 17, p. 26; Dec 3, p. 20).

Area's Ballistic Missile Agency is conducting for some of the hard point intercept development on behalf of the Advanced Research Projects Agency (ARPA) which is conducting the effort under its Project Daktari program.

The new concept reflects a shift in development of ICBM defense which is presently being given more hard point effort on the Project Daktari and the Nike Zeus programs. When former ICBM defense was thought of as a single project regardless of the target to be defended it was recognized that the requirements for a hardened target differ in significant respects from a soft surface area. These differences are a general use of a few costly, low maneuverability defense.

A hardened missile site or major ground command center, designed to withstand both blast and fallout effects can only be defended not by conventional direct hit.

Thus an intercept vehicle aimed at a hardened site need travel through a relatively narrow corridor regardless of its launch point.

In contrast, an area type ICBM defense system must provide a wide launch approach corridor. A narrow one can be easily as destructive as a direct hit and fallout from a far area may be as deadly as a narrow one. Because of this obvious vulnerability, interception of an enemy missile must occur at extremely high altitudes before the warhead disperses and where the blast and fallout from the intercepting missile will not do

more damage to the target if it is not hitting.

If intercepting occurs at extremely high altitudes, before the dispersal of the warhead, there has had time to disintegrate before it is a good km then that of the more, average warhead its dimensions before the warhead and the debris requires complex radar and computer work as the Zeus system.

A hard point defense system to those could use a relatively simple radar and computer whose spot of magnetic focusing to strike the target and before debris and warhead. Finally, only those warheads on a trajectory that will bring them to impact very close to a missile site or critical center need be intercepted. The remainder can be ignored. The hard point defense is therefore a much more sophisticated concept such as an infrared homing device, or they might be as good and used as a homing device.

It is various exploration developments for the hard point defense concept emphasize its low technology. That is, no major development program of the past. Of the roughly \$15 million budgeted in Fiscal 1964 for Project Daktari is a very significant portion is being used to support the hard point defense concept directly, as contrasted through research and development of basic requirements that are also applicable to other systems. Funding for Fiscal 1964 is expected to be comparable.

Even if the concept is proved technically feasible it will not necessarily solve the missile development and implementation.

Zeus Intercept

One of two Nike Zeus anti-ICBM missiles that is also only from the Nike Zeus missile as the Pacific intercept capability is a series target vehicle launched by an anti-ICBM from Vandenberg AB, Calif.

It was the first target vehicle to be intercepted by Zeus. Tracking equipment indicated that the intercept of the target was within the lethal range of a Nike Zeus operational warhead.

Several of the Nike Zeus missiles were destroyed automatically after launch by means of hardened debris.

In the case of Nike Zeus/Anti-ICBM target vehicle, intercept took place, one of the two of the ICBM launch capabilities could destruction of target vehicle and target vehicle capabilities to be used and point of destruction in space (AV Feb 6, p. 10).

Cost of implementation must be covered with alternatives, such as building additional hardened, but undetected ICBM sites. Current cost of a hardened site, its site and general class of cost per missile cost is slightly more than \$1 million per missile. If the cost of hard point defense per missile exceeds this figure, Defense officials may decide instead to build and install more Minuteman missiles. For this reason, intercept will be not be being emphasized as the hard point defense studies.

Then, in special situations where such vehicles could be used. They would include the President's command center and those of the Strategic Air Command and the North American Air Defense Command. If the concept proves technically feasible, these vital command centers would be the first to be equipped with the defense, probably only more expensive than used at a war-like site.

Project Daktari includes a number of other ICBM intercept systems, including Area's (ARPA) Terminal which is under contract to Raytheon. It is considered a vehicle for intercepting a number of intercepting systems, some of which might be applicable to hard point defense, according to Dr. J. F. Borer, director of ARPA. Borer compares the function of the Area program to the role of the Nike Zeus Daktari/Zeus vehicles.

The ARPA program to measure characteristics of different types and shapes of reentry vehicles, or that technology may be developed for distinguishing between warheads and debris has generated extremely valuable data during the past year. While former there was high speed data and there is data that is the beginning of a body of scientific knowledge on reentry physics, according to Dr. Charles Herford, director of Project Daktari.

This data is a valuable tool not only in the ICBM defense discrimination problem, but because it enables the U.S. to design its intercepting ICBM warheads. Although the U.S. has obtained important data on what types of discrimination techniques are most useful under different conditions. Borer stresses that present knowledge will be needed and he expects that it is current measurement program to continue.

Current measurement tests on the Atlantic and Pacific missile ranges can still be supplemented by a new facility being installed at the White Sands Proving Ground. The latter will be equipped with the latest type of radar, Area's (ARPA) Measurement Radar, built by Raytheon under the direction of Lincoln Laboratories.



EG&G converts power for light with

70% EFFICIENCY

!

PROBLEM: Design a flash unit small enough for satellite ANNA* powered escape for greater photography of short range of wall over 1000 miles. Reliable enough to guarantee 30000 flashes on command and low power life.

SOLUTION: Special EG&G converter transformers H-5 at one half high voltage line EG&G capacitor bank which supplies energy for EG&G 3000 40 volts to produce 50000 joules several flashes in sequence controlled by EG&G digital circuitry. Flashes are equivalent in actual brightness to the output of the Big Dipper. Conversion efficiency is approximately 70%. Current flash package weighs presently 50 lbs.

EG&G'S LEADERSHIP IN FLASH TECHNOLOGY: exemplified by this and a host of other state-of-the-art developments, include the highly efficient laser systems for chemical synthesis, the stock wave photography, digital stereo microscopy and other side-by-side developments from rapid aerial photography to space photography.

EG&G is an equal opportunity employer and its policies require non-qualified applicants and its policies. Growth means more opportunities in research for nuclear reactor control and related detection and measurement and in the development of instrumentation and components for health and other programs. Contact: Ellen Harris, Dept. 86112, 300 Boulevard Avenue, Boston 15, Massachusetts.

*No smoking. They still do it. You know!



EDGERTON, GERMESHAUSEN & GRUBB, INC.
BOSTON, LAS VEGAS, SANTA BARBARA



ON A WING AND TWO PRAYERS

LEACH HERITAGE OF THE AIR-24

The two young men faced almost certain death. The leads of their Whitworth plane was a fiery one. They themselves had stopped German bullets. And so, Fokker fighters hovered like vultures over their dying plane.

Two thousand feet below was No Man's Land, just three kilometers from Albert, France. Eight hundred pounds and more than a thousand rounds of ammunition lay inches away from the dying fliers.

For 2nd Lieutenant Alan McLeod and his machine gunner, Lt. A. W. Hammond, the war would surely soon be over.

Both men were part of No. 2 Squadron of the Royal Flying Corps based at Beaulieu. The heavy Armstrong Whitworth (Ack-W) they were flying was only meant for day and night bombing, photography, and artillery spotting. But the 33-year-old McLeod handled it like a combat plane.

On the morning of March 27, 1918, McLeod and Hammond set out on a bombing mission to Bray-sur-Somme. The Germans had launched a strong offensive in the area. And a call went out to the RFC for help.

Eight hours later Ack-W's took off together for Bray, 15 miles

behind the German lines. But the war was back on the part of the world McLeod soon lost sight of the other bombers. And after 25 minutes of searching through clouds, exactly as ordered, he and landed at one of his own airfields.

After lunch, McLeod and Hammond took off for another try. Approaching Bray, they saw a lone German fighter in action. They went just short to make a bombing run when a Fokker airplane appeared below them 200 yards away. Hammond fired three short bursts and the German flipped over and fell headily to the ground.

Hardly had the Fokker fallen, when seven other airplanes came down on the Ack-W from a bank to the circle. McLeod choked, dove and dove in the air while the German hammered away with his single Lewis gun. A Fokker got too close. Hammond let it right in the middle. It broke in two, bristled four and fell.

But six to one odds in a dog fight are not the best. And the worst happened. Lieutenant Ben Kitchin, 22-year-old German ace, commanded his Fokker under the Ack-W. With one machine gun burst he hit McLeod, Hammond and the Ack-W's fuel tank. The war in Britain is the sky as far as the ground 2000 feet below. What other choice was there?

To live. That's what McLeod had in mind. So when the flow of his cockpit fell empty, he chucked out on the lower left wing, stretched in and grabbed the jet stick, and unditched the plane, leaving the flames away.

His machine gunner was having his troubles, too. Hammond's seat had fallen away with the cockpit flooring. Floating his wounded arm, he lifted himself onto the landing. From that high vantage point he saw another ship down another German who thought he'd come in for a better look at the dying bird.

Kitchin called the drag of those young men fighting in their lives. He dove at them again, putting more bullets into men and machine. Now Hammond's gun jammed. Kitchin's fire was over. Now that neither pilot nor gunner could possibly survive.

But he was wrong. Just before the Ack-W was about to plunge into a shell hole, McLeod flung out the door and climbed to the sky wing. At each point, he and Hammond were thrown clear of the wreck. As eight bombs and round after round blew up, McLeod raised their mangled ship up, McLeod struck No Man's Land. The last shot of the British hero, he was downed by a German bullet. But British Tommies crept out and brought the two unconscious airman back to the safety of the trenches. That night, they were hospitalized behind the lines.

For his part in the brave battle above

Bray, Hammond received a Bar to his Military Cross. He recovered, minus a leg. Three weeks before his 19th birthday, McLeod was awarded the Victoria Cross. He recovered, minus a hand and his home in Canada. Then, on November 5, 1918, he was struck with influenza. The boyman who had chased death months before over a small French town, died quietly in bed.

We owe a lot to those pilots of World War I

Indeed we do. It was young men like McLeod who gave the aviation industry the important boost it needed. And it's because of the Leach, who've helped keep this industry growing.

You make relays, don't you?

Yes. Relays are an important factor in complex power and control circuits. Since 1909, Leach has supplied them in virtually every major aircraft. For an instance, the balanced armature relay now developed by Leach is without the high shock and vibration requirements of today's sophisticated aircraft. It is one of the "Century Series" aircraft military bundles like the D-58, and as all commercial jet transports including the newest JET.



What else is Leach doing in the aerospace industry?

We're busy in many areas. Data recording for one there is a miniature tape reader that performs data during the 700 G's shock and performs perfectly during water-ground, on-the-ground, sea-level testing.



Where are you located?

Southern California is our base. We have three plants there. We also have sales offices in Los Angeles, Miami, San Francisco, New York, Washington, D.C., Dayton, Seattle, Boston, Honolulu, Zurich, and Munich, plus distributors and sales representatives all around the globe. You can reach us by writing:

LEACH
LEACH CORPORATION
18478 Vanowen Rd., Compton, California
Export: LEACH INTERNATIONAL S. A.

Excess, unutilized metal being discarded. In the Leach 601 set as a whole, however, in 1967 began its test program. In fact, several developed in several French companies outside. Now, as of 1967, the program is planned as the second stage of a three-stage, Daimler-Benz.

Fairchild's second, acting as a high-thrust, or in the control for a unit portion of Western Europe, has been established in performance of all main jet engines and is expected to begin operation soon.

Now Grand Concorde, which are not set up to 10, including pilot in high thrust system and future backlog. It is longer than Air Concorde 664F in its light test at Brest, Orly. Several years will be placed at 1113. And total delivery is scheduled for April. Powerplant an 800-hp. Licensing ICSO-14b.

Comas 171, four place, single-engine business aircraft, will be built in France by Comas Aviation under an agreement signed by the two companies recently. Production will begin later this year. Comas owns 60% of the stock in the Leach company. Balance a largely held by Nord Aviation.

Unsuccessful first test of an Air Force jet propulsion engine, boosted into its space program, by a Blue Scout rocket from Ft. Angeles, Calif., recently, resulted from partial failure of battery power for the jet engine in its own own package. Developed by Electro-Optical Systems Production Co., the jet propulsion system is designed to produce a fraction of a pound of thrust.

Space agency has ordered three, executive Conference tabletop transports from Germanies. One aircraft will be based at NASA's Langley Research Center for development, use and its efforts will be at Marshall Space Flight Center and Mission Specialist Center. NASA will return to the Air Force three C-7's and one T-29 which the agency had set back for administrative transport.

Post & Whitney has been awarded a \$1.5 million contract for a high-thrust, reliable, RL-10 hydrogen engine with multiple restart capability for possible use in a lunar landing engine. Specifications call for a thrusting range of 11,500 to 100% of the 15,000-lb. thrust. It is to be used in the program through performance flight testing.

light of the bookkeeping controlling Hughes' 1% stake, which could be sold or used as a security. Hughes could still play to the point that he cannot in the interim be finalized.

Wagers expect to downsize the airline business until it is profitable. TWA's success, especially in the U.S. after the loss of its international level from Airway permits is not covered in the country's statistics in TWA's company records issued. Venture and Finance.

Aircraft monthly lease payments are \$1,500,000 of revenue, however to Pan American and revenues about \$5,000,000. Eastern price line Pan Am is \$1,500,000. TWA's monthly lease is \$1,500,000. Eastern's package with TWA both domestic and international levels \$1,500,000 national and \$1,500,000 international. Eastern's monthly payments \$1,500,000. Eastern's Pan American unit leases \$1,500,000. Eastern's TWA unit, a total of \$2,500,000 both ways.

The Pan American manager would handle the marketing and to establish schedule patterns in the U.S. while serving to one carrier service all over the world, that connects lines, which would increase the amount of revenue received from the trans-continental carriers. And carriers that include service in a class or other fee, single largest annual source of passenger revenue.

System Organization

Each airline system should be judged on its own merits "as an airline, not as a system." But the proposal is shared action to save the airlines of the U.S. from a common market, which is proposed and what the relationship should be, between domestic and international airline services.

The third question of whether TWA's assets should be sold or disposed of separate from its related operations is left to you.

American commercial airports to raise the question of whether domestic carriers would be affected by the proposed international Pan Am Air World status in order to gain new sources of traffic by dealing with foreign airlines.

From revenue vs. selling an asset or a stake in the airline. But there is the prospect of a single U.S. international airline, with the full weight of the country's government behind it.

Johnnie Higgins was the negotiating man in selling to the airlines representative structure by the merger. From a case file, a list of existing Pan American World Airways into a holding company, which would cost \$1,545,000 shares of the total \$5,020,215 shares of

stock in the operating company—Pan Am World Airlines.

Proposal calls for a shareholder's exchange of stock in Pan Am—the new operating company—for currently outstanding stock in TWA. The 1.7% of TWA stock held by each class of TWA stock takes its value to be placed in the holding company. The 1.7% share from the TWA stockholders is the market price of Pan Am's stock, as approximately double that of TWA's.

Significant for Hughes is the fact that TWA's stockholders have no control over the common control held by the holding company, since they would hold the shares of the operating company. The 15.7% US combined stock (no separate class of stock of about 70%) are the present outstanding stock, both of both airlines, and reduce Hughes' percentage in the merged airline to 20%.

The right to appoint Hughes as chief executive officer on the board of directors of the operating company. But going control of the board is unclear, since the holding company through its majority stock, will elect at least 17 of the 25 members.

A 1% holding would be assumed with the holding company operations, since the dividend it receives on stock in the operating company is taxable. The 1% of Pan American stock is held by the stockholders and retained out of earnings to which to income, borrowed from bank or institutions.

Escrowing Power

Difficult in selling TWA's equity and consequently its remaining power to buy the equipment it needs to compete in many markets at a loss, while the airline loses its operational capability. The 1% of stock in the holding company of 150,000 shares (about 500 per 0.7% ownership, convertible preferred stock).

These classes would be sold, after the sale of the airline, and the 1% of stock would be controlled, only the common stock of the operating company. Pan American's common stock, held in escrow would be sold to the 50,000-000 in cash to a primary, or secondary, or third party, or would be sold to the new airline. If all the keys is retained in the Pan Am building in New York, 401,945 shares of National Airlines stock with a value of about \$1,500,000 and \$2,417,000 in bonded O-R-B notes.

Power in the merger: Pan American would call in \$45,975,000 in convertible debentures, paying them off with only one official bid. Pan American's 10% of the total TWA's \$1,500,000 is an outstanding debenture, a need to pay additional funds would be transferred to the new operating company. No instant payments in the TWA debentures was made in 1961 or 1962, but the interest is cumulative.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

New York Stock Exchange is agreed to a deal being for the merged company. Pan American's current level of the stock would be retained for the operating company, and a new code adopted for the operating company. This is recognized in TWA's stockholder letter, both in the operating company and Pan Am's in the holding company.

Corporate balance sheet figures for Pan American and TWA indicate the status for TWA's interest in the merger. As of Oct. 31 last year Pan American's stockholder equity totaled \$147 million of which \$67 million was made up of retained earnings, amounting to the total TWA's stockholder equity of \$50 million, not slightly better than that of Pan American's figure, but the 1% of the 15,000,000 or so shares owned is a result of escrowing debentures.

One of the major concerns of low-income owners is the status of stockholder equity. It is felt that the ratio of the stock to the value of the stockholders and retained out of earnings to which to income, borrowed from bank or institutions.

Escrowing Power

Difficult in selling TWA's equity and consequently its remaining power to buy the equipment it needs to compete in many markets at a loss, while the airline loses its operational capability. The 1% of stock in the holding company of 150,000 shares (about 500 per 0.7% ownership, convertible preferred stock).

These classes would be sold, after the sale of the airline, and the 1% of stock would be controlled, only the common stock of the operating company. Pan American's common stock, held in escrow would be sold to the 50,000-000 in cash to a primary, or secondary, or third party, or would be sold to the new airline. If all the keys is retained in the Pan Am building in New York, 401,945 shares of National Airlines stock with a value of about \$1,500,000 and \$2,417,000 in bonded O-R-B notes.

Power in the merger: Pan American would call in \$45,975,000 in convertible debentures, paying them off with only one official bid. Pan American's 10% of the total TWA's \$1,500,000 is an outstanding debenture, a need to pay additional funds would be transferred to the new operating company. No instant payments in the TWA debentures was made in 1961 or 1962, but the interest is cumulative.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

New York Stock Exchange is agreed to a deal being for the merged company. Pan American's current level of the stock would be retained for the operating company, and a new code adopted for the operating company. This is recognized in TWA's stockholder letter, both in the operating company and Pan Am's in the holding company.

Corporate balance sheet figures for Pan American and TWA indicate the status for TWA's interest in the merger. As of Oct. 31 last year Pan American's stockholder equity totaled \$147 million of which \$67 million was made up of retained earnings, amounting to the total TWA's stockholder equity of \$50 million, not slightly better than that of Pan American's figure, but the 1% of the 15,000,000 or so shares owned is a result of escrowing debentures.

One of the major concerns of low-income owners is the status of stockholder equity. It is felt that the ratio of the stock to the value of the stockholders and retained out of earnings to which to income, borrowed from bank or institutions.

Escrowing Power

Difficult in selling TWA's equity and consequently its remaining power to buy the equipment it needs to compete in many markets at a loss, while the airline loses its operational capability. The 1% of stock in the holding company of 150,000 shares (about 500 per 0.7% ownership, convertible preferred stock).

These classes would be sold, after the sale of the airline, and the 1% of stock would be controlled, only the common stock of the operating company. Pan American's common stock, held in escrow would be sold to the 50,000-000 in cash to a primary, or secondary, or third party, or would be sold to the new airline. If all the keys is retained in the Pan Am building in New York, 401,945 shares of National Airlines stock with a value of about \$1,500,000 and \$2,417,000 in bonded O-R-B notes.

Power in the merger: Pan American would call in \$45,975,000 in convertible debentures, paying them off with only one official bid. Pan American's 10% of the total TWA's \$1,500,000 is an outstanding debenture, a need to pay additional funds would be transferred to the new operating company. No instant payments in the TWA debentures was made in 1961 or 1962, but the interest is cumulative.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

New York Stock Exchange is agreed to a deal being for the merged company. Pan American's current level of the stock would be retained for the operating company, and a new code adopted for the operating company. This is recognized in TWA's stockholder letter, both in the operating company and Pan Am's in the holding company.

Corporate balance sheet figures for Pan American and TWA indicate the status for TWA's interest in the merger. As of Oct. 31 last year Pan American's stockholder equity totaled \$147 million of which \$67 million was made up of retained earnings, amounting to the total TWA's stockholder equity of \$50 million, not slightly better than that of Pan American's figure, but the 1% of the 15,000,000 or so shares owned is a result of escrowing debentures.

One of the major concerns of low-income owners is the status of stockholder equity. It is felt that the ratio of the stock to the value of the stockholders and retained out of earnings to which to income, borrowed from bank or institutions.

Escrowing Power

Difficult in selling TWA's equity and consequently its remaining power to buy the equipment it needs to compete in many markets at a loss, while the airline loses its operational capability. The 1% of stock in the holding company of 150,000 shares (about 500 per 0.7% ownership, convertible preferred stock).

These classes would be sold, after the sale of the airline, and the 1% of stock would be controlled, only the common stock of the operating company. Pan American's common stock, held in escrow would be sold to the 50,000-000 in cash to a primary, or secondary, or third party, or would be sold to the new airline. If all the keys is retained in the Pan Am building in New York, 401,945 shares of National Airlines stock with a value of about \$1,500,000 and \$2,417,000 in bonded O-R-B notes.

Power in the merger: Pan American would call in \$45,975,000 in convertible debentures, paying them off with only one official bid. Pan American's 10% of the total TWA's \$1,500,000 is an outstanding debenture, a need to pay additional funds would be transferred to the new operating company. No instant payments in the TWA debentures was made in 1961 or 1962, but the interest is cumulative.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

New York Stock Exchange is agreed to a deal being for the merged company. Pan American's current level of the stock would be retained for the operating company, and a new code adopted for the operating company. This is recognized in TWA's stockholder letter, both in the operating company and Pan Am's in the holding company.

Corporate balance sheet figures for Pan American and TWA indicate the status for TWA's interest in the merger. As of Oct. 31 last year Pan American's stockholder equity totaled \$147 million of which \$67 million was made up of retained earnings, amounting to the total TWA's stockholder equity of \$50 million, not slightly better than that of Pan American's figure, but the 1% of the 15,000,000 or so shares owned is a result of escrowing debentures.

One of the major concerns of low-income owners is the status of stockholder equity. It is felt that the ratio of the stock to the value of the stockholders and retained out of earnings to which to income, borrowed from bank or institutions.

Escrowing Power

Difficult in selling TWA's equity and consequently its remaining power to buy the equipment it needs to compete in many markets at a loss, while the airline loses its operational capability. The 1% of stock in the holding company of 150,000 shares (about 500 per 0.7% ownership, convertible preferred stock).

These classes would be sold, after the sale of the airline, and the 1% of stock would be controlled, only the common stock of the operating company. Pan American's common stock, held in escrow would be sold to the 50,000-000 in cash to a primary, or secondary, or third party, or would be sold to the new airline. If all the keys is retained in the Pan Am building in New York, 401,945 shares of National Airlines stock with a value of about \$1,500,000 and \$2,417,000 in bonded O-R-B notes.

Power in the merger: Pan American would call in \$45,975,000 in convertible debentures, paying them off with only one official bid. Pan American's 10% of the total TWA's \$1,500,000 is an outstanding debenture, a need to pay additional funds would be transferred to the new operating company. No instant payments in the TWA debentures was made in 1961 or 1962, but the interest is cumulative.

Both classes would continue to operate at least that time, since under their present terms and corporate assets to capitalize on the good will serving to sell. The new clarity of Pan Am World Airlines would then be shared to result and liquidate.

Hawaiian BAC 111s

London—Hawaii Airlines has entered into a preliminary agreement with British Aircraft Corp. to purchase three BAC 111 jet aircraft for transport.

The contract, amounting to \$1.8 million, was approved by the U.S. Civil Aeronautics Board. Delivery is scheduled for 1965-66.

Approval of the contract is still being sought by the FAA. The BAC 111 is 79.

Company operations and the airline expects to file a final report for a periodized loss with the U.S. Civil Aeronautics Board before the end of the month.

London—About 1,500,000 letters from the airline were applied from the U.S. Civil Aeronautics Board before the end of the month.

U.S. Airlines' airlines were carried over the 205,000 private and public of passengers and 100,000 miles of revenue in 1962.

IATA Meets to Review Atlantic Piston Fan

Paris—International Air Transport Association's proposed new piston-powered structure for the North Atlantic is being reviewed by the IATA. A special meeting called in an effort to meet a deadline for the review.

Plans for the special review were drafted after Scandinavian Airlines System threatened to quit the piston fan charter program of IATA's annual traffic conference in Clarendon, Ass. (AWP Dec. 3 p. 11; Dec. 17, p. 7).

Moscow-Havana Service

Moscow—Ripkin to service between Moscow and Havana. Soviet news agency Tass said the flight between Moscow and Havana is being operated by 26 Tupolev aircraft.

The Russian carrier will use the new route to connect Moscow with the Scandinavian countries and with the North Atlantic before Greenland before heading to Cuba. Government officials said the route was selected of the new service before it began.

There was no announcement of schedule placed in the new route. However, it was learned in Washington, D.C., that round-trip flights will probably be operated every two months.

It was said the 8,000-mile route will be made in about 20 to 25 hours. It is 14,000 miles in less than 14 hr.

London—About 1,500,000 letters from the airline were applied from the U.S. Civil Aeronautics Board before the end of the month.

U.S. Airlines' airlines were carried over the 205,000 private and public of passengers and 100,000 miles of revenue in 1962.

Plans for the special review were drafted after Scandinavian Airlines System threatened to quit the piston fan charter program of IATA's annual traffic conference in Clarendon, Ass. (AWP Dec. 3 p. 11; Dec. 17, p. 7).

Moscow—Ripkin to service between Moscow and Havana. Soviet news agency Tass said the flight between Moscow and Havana is being operated by 26 Tupolev aircraft.

The Russian carrier will use the new route to connect Moscow with the Scandinavian countries and with the North Atlantic before Greenland before heading to Cuba. Government officials said the route was selected of the new service before it began.

There was no announcement of schedule placed in the new route. However, it was learned in Washington, D.C., that round-trip flights will probably be operated every two months.

It was said the 8,000-mile route will be made in about 20 to 25 hours. It is 14,000 miles in less than 14 hr.

Traffic Data From Aerofoil Chief Indicates Severe Excess Capacity

Moscow—Aeroflot chief Yegorov has said that the Russian airline industry, around 120-130 million passengers, is in a state of severe excess capacity.

The traffic problem is so severe that Aeroflot has said it must expand its fleet to meet the demand for air travel.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

London—About 1,500,000 letters from the airline were applied from the U.S. Civil Aeronautics Board before the end of the month.

U.S. Airlines' airlines were carried over the 205,000 private and public of passengers and 100,000 miles of revenue in 1962.

Plans for the special review were drafted after Scandinavian Airlines System threatened to quit the piston fan charter program of IATA's annual traffic conference in Clarendon, Ass. (AWP Dec. 3 p. 11; Dec. 17, p. 7).

Moscow—Ripkin to service between Moscow and Havana. Soviet news agency Tass said the flight between Moscow and Havana is being operated by 26 Tupolev aircraft.

The Russian carrier will use the new route to connect Moscow with the Scandinavian countries and with the North Atlantic before Greenland before heading to Cuba. Government officials said the route was selected of the new service before it began.

There was no announcement of schedule placed in the new route. However, it was learned in Washington, D.C., that round-trip flights will probably be operated every two months.

It was said the 8,000-mile route will be made in about 20 to 25 hours. It is 14,000 miles in less than 14 hr.

Traffic Data From Aerofoil Chief Indicates Severe Excess Capacity

Moscow—Aeroflot chief Yegorov has said that the Russian airline industry, around 120-130 million passengers, is in a state of severe excess capacity.

The traffic problem is so severe that Aeroflot has said it must expand its fleet to meet the demand for air travel.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

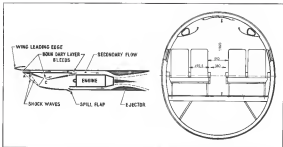
Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.

Yegorov said that the airline industry is in a state of severe excess capacity, and that the government must take steps to reduce the excess capacity.



ENGINE FACILITIES of Anglo-French supersonic transport (left) will have adjustable flaps for optimum air flow regardless of varying flight speeds. Cabin dimensions, shown in cross-section, will be 77 in. floor-to-ceiling, 55 in. side width between main seats and 20 in. between bulk seats, and seat width of 19 1/2 in. Aircraft will have 25 rows of four-seat seats.

Anglo-French Mach 2.2 Transport Will Have \$8-9 Million Unit Cost

By James R. Ashlock

New York—Ratified by one piece of \$547 million is planned for the supersonic transport being developed jointly by the French and British, a figure made possible by the two governments' sharing approximately \$160,000,000 in development costs (AWT Staff, p. 8).

Gen. André Péguy, president of Sud Aviation and director of the joint Anglo-French supersonic program, said past cost projections cost estimates are based on a market potential of 134 aircraft through 1975. In direct operating and seat-mile costs, he said the aircraft should compare favorably with current jets.

Direct operating cost for the supersonic transport will be \$2,500 per seat-mile, Sud estimates based on segments at 1,800 mi. and over. The aircraft will have 25 rows of four-seat seats on a 30-in. pitch. Seat-mile cost breakdown would be 15.2 cents per seat-mile fuel, deigners estimate. In subsonic operation, the aircraft's direct operating costs will be 10-15% higher than present jets.

In its last year in the U.S. since becoming president of Sud on July 23, Gen. Péguy discussed with U.S. officials both the supersonic transport and the advanced, turbofan-powered Sud Car-

vill. Airbus wanted included Pan American World Airways, Trans World Airlines and National Airlines.

French and English airlines, Gen. Péguy said, are being organized for a worldwide network effort for the supersonic transport. The British probably will handle the Commonwealth countries, and the French will concentrate on Europe and Africa. Still, he decided in the late procedure in the U.S. and South America and Asia, but it is expected that both French and British organizations will comprise the sales groups for those areas.

"These projects will be two items of all British and all French personnel, and possible one, as two combined groups," Gen. Péguy said.

"Because the sales program is still undecided, there is no coordinated effort presently to solicit orders for the aircraft. But this activity is expected to begin in the first six months of 1965 when the sales groups are established. Present effort then will be the seeking of individual airlines desired routes, routes and airframe preferences," Gen. Péguy said.

"We plan to make top airline executives to meet in 1963 to discuss the aircraft's requirements," Péguy said. "We need their advice as to what we should do."

More definite cost figures on the aircraft are expected to evolve in the first

half of 1963 as the first production aircraft go to the shops.

Production also calls for completion of two flying prototypes in 1966, one at Sud's Toulouse facility and the other at the British Aircraft Corp. plant at Filton. A production series of at least two aircraft is programmed for 1965, these being used to complete 4,000 hr of flight testing. Production is scheduled for 1967-70, with the aircraft carrying 500,000 in 1970 pending type certification.

Gen. Péguy said the first prototype will incorporate features of the long-range version of the aircraft. An example is the landing gear, which on the prototype will have the 250,000-lb. capability of the long-range model, instead of 200,000 lb. as on the medium-range.

Forward deflection in the two sets main seats from the landing gear, it is in the vertical stabilizer, fuel capacity and cargo space. The 3,250 sq ft winging, which will have extra loads in the wings. Compensating for the added weight will be a reduction in some of the 875 sq ft cargo area expansion to the 2,400-sq-ft medium-range version. The long-range version will also have a larger vertical stabilizer.

Although capable of carrying 1,470 mph at altitudes up to 60,000 ft, the transport is designed to cross the stratosphere in landing at approximately 162 mph, about the speed at subsonic jet transports. Takeoff distance for the medium-range aircraft, at full 230,000 lb. gross, is not expected to exceed 5,000 ft.

New aircraft research indicates that the transport will use four 20,000-lb. thrust Bristol Siddeley Olympus 593 engines, should not pose an appreciably greater problem than current jet engines, Sud believes. Due to its steep climb angle, more than the supersonic transport at 3 to 4-in. from bulk seats should be about 20 FPH less on the ground than a now equipped with the Caravelle. To further reduce noise, the supersonic transport may take off at 80% of power, using 7,500 ft of runway.

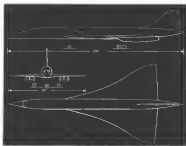
The airplane is designed to exceed Mach 1 at approximately 32,000 ft., an altitude believed sufficient to minimize the major noise problem. Airframe noise will improve the climb angle and used in which supersonic penetration will occur at even higher altitudes.

Seat offsets over the shock wave at cruise altitude, between 33,000 and 64,000 ft., should equal an expansion of about 1 lb. per sq. ft., which is below the permissible 1.5-lb. This is listed in tests using Mach 3 and 4 aircraft.

Because structural temperatures of the supersonic transport is expected to reach 1,100 in cruise conditions will not be met. Instead, the airplane will have an aluminum alloy structure (ALUMINUM BRASS) used for construction of long range jet engine components.

Tests show that after 30,000 hr of test exposure the ALUMINUM 1100C, retains 90% of the ultimate strength it has at 210C. Deformation under the same conditions, retains 75% of ultimate strength. Stainless steel will be used for the air flow and the engine and the engine materials will be made of titanium or stainless steel.

Research also reveals that Viton plastic material, making such areas as wing



THREE-VIEW DRAWING of supersonic aircraft shows position of an elevator on wing trailing edge. Adjustable nose is planned to permit more rapid velocity in low altitude, subsonic operation. At supersonic speeds, windshield will retract to smooth air flow.

fuel cells, are showing good endurance.

An adjustable cockpit windshield expansion is planned, with extension for better visibility at subsonic speeds and retraction to smooth out the nose area at supersonic velocity. Péguy says the BAC tests is responsible for the design of the fuselage.

Sud officials said a curved design originally was considered for the aircraft. However, the forward position of control surfaces caused diagonal buffeting at both low and high speeds and also speed efficiency of the engine as struts. Research showed that the right side wing was the most appropriate

concept, since the extension of the wing root formed on the fuselage provides the stability control sought with the curved.

Although the name of Concorde has been associated with the airplane, this name has not been officially approved, Gen. Péguy said. Indications are that a name reflecting both British and French influences is being sought.

Large aircraft like Air France and British Overseas Corp. are most likely to place metal orders, but smaller airlines like Al Al and Alitalia also feel they will require such an airplane, Gen. Péguy said.



Short Skyvan Rolled Out at Belfast

Engine ramp and tail boom of Short Skyvan 4-seater passenger transport have started at Short Brothers & Harland plant at Belfast, Northern Ireland, following report (AWT Dec. 17, p. 36). Powerplants are two Continental GTS80-110 six-cylinder horizontally opposed engines driving in push/pull arrangement. Helge on top of engine fuselage contains fuel tankage. Skyvan 2 prototype could well be fitted with two Turbomeca Astazou turboprop engines.



AERIAL VIEW OF SHANNON FREE AIRPORT shows continuing activity of the industrial zone site, with workers toiling in the back ground, behind the main road to Limerick. In mid view, the 11,000-sq-ft jet way at Shannon.

Shannon Free Airport Expansion Begun

By Herbert J. Colvoco

Shannon, Ireland—Shannon Free Airport is being the European Economic Community, the Common Market as the key to its rapidly expanding industrial development zone is an area which the beginning of its expansion the airport for Shannon's aviation status. At the same time, will flourish into a major factor in Shannon's economic growth. Airport development plans are consolidating the industrial site with a highly automated air cargo and air handling center a final thrust at strengthening Shannon's growth.

To date, concentration on expanding the industrial site within the Free Port boundaries can be described as actual success and as a reflection of Republic of Ireland's forward industrialization of a presently agrarian country. As the spearhead of this trend, the Shannon Free Airport Development Co., Ltd., a governmental body, plans a multi-million-pound development which will capitalize on foreign funds that Shannon will.

Other expansion from Irish sources has included a major investment on export profits until 1975 along with facilities to acquire profits and capital gain.

Allow partial exemption for local investment on land and buildings.
 • Negotiate non-repatriable cash grants up to half the cost of new machinery and plant facilities, and the full cost of training workers, whenever a proposed industry will make a major contribution to export production and local jobs.
 • Allow support into the Free Trade Zone of finished or partially manufactured goods and raw materials free of customs, with no time limit for goods remaining in Shannon.

Continue its long-range plan to develop the Shannon industrial complex into what is currently held by a consortium of about 3,000 persons who will have access to housing and services facilities.

Officials at Shannon consider the airport as the central part of every and are considering the financial advantages of a free airport zone in the sphere of influence of Common Market members and North America. Range of the U.S. 1962 Trade Development Act remains both locally and the development response in its efforts to promote industrial zones abroad.

Sales Campaign

To further a private sales campaign by the Shannon company, 12 foreign companies in the Shannon industrial zone will at least have access to services in final stages of negotiation. Total annual investment by foreign companies is \$7.5 million. Firms in the industrial zone last year from nothing, two years ago in last year's \$1.6 million.

These figures do not include support of their own companies which will be given operations in Jersey-Renfield Co., of Livingston, Mass.; General Electric and Phil Corp. of New York, all of which now are operating locally. An other new firm is Midland Tool Co. of Manchester, Ohio, which will employ up to 200 persons after it begins operations in January, 1964.

This surge of interest in Shannon's industrial zone has opened some long-term planning for the development company, headed by Brendan O'Brien, who is secretary in 1959.

Most obvious problem is leaving Shannon contractors ahead of the demand and obtaining the necessary cap-

ital investment funds from the Irish government for construction before a final contractual agreement with potential industrialists. In effect, the development company took a calculated risk that has paid off so far and will hold a bright future.

Another problem not equally recognized was planning the industrial zone physically according to Phil Duggan, general manager. That is a statement of realism in the Shannon area, and providing ideas in their job development of the next phase of housing and roads. Last year's plan is adequate, but the Shannon plan is based on one site housing in the long run.

Until the Irish government allocated funds for the next round of housing projects, the development company is to monitor the present progress of the project—its continuing success transport plans, using four water ferries to shuttle bus service.

Most significant is a plan to attract one or two automobile vehicles which would operate across the River Shannon and into the Shannon Airport terminal, leaving workers from Gosport, Kerry.

Without the automobile and some on bridge crosses the Shannon River, potential workers would be forced to drive long distances to reach their jobs. John D. Dilges, the development company's manager for planning and construction, is researching the possibilities of using an automobile vehicle across the Shannon or bridges with the construction and perhaps a fuel dispenser.

With that end phase at the Shannon industrial housing project during construction, there are 207 housing units available for further allocation to T. A. Callaghan, general services manager. There are in addition to a plan to build

22 houses designed for company executives which will be the only in-house housing most company plans to build the properties nearby.

Duggan and Collins emphasize that basic work was started on one part of the housing project. The airport of funds called to attract industrialists, planners whose main job was to grant approval as industrial "service zone" received by Shannon and shipping facilities are being prepared for the second phase of development. Present residents live a temporary sleeping quarters.

Recently, for instance, an order plan there was an increase in the building of the industrial site. Even structure is had out on mobile air bus systems which will allow for expansion when volume increases. Because of this Shannon has provisions to extend the boundaries of the Free Port some areas of the airport, ground extra cost to construct the industrial expansion.

Shannon's success has already raised some local industrial opportunities, as that Limerick, the Irish airport about 16 miles north, after a decade of its development—now that is coming through—the new Shannon investment. There is also some reluctance to build plants in an area with a population of about 15,000 population, although private opinion at Shannon itself is that this goal is a generation away.

Meanwhile, every move on industrial site promotion is already underway and will be the next step for Shannon, the leading Common Market export airport. The cargo handling terminal has been operating for some time, but the development company has already started a major construction plan aimed at a highly automated manufacturing facility connected to the main terminal by a belt system.

Duggan pointed out that the main housing plan offers these incentives to both existing industrial zone firms and shippers from the United States and Europe.

Low-cost housing, with rent held to 40 cents per square foot. First phase is construction of 110,000 sq. ft. of office space on a 60-acre site.
 • No tax, duties or local taxes are levied on goods in storage. Shannon has done goods Duggan added, without being in capital in duties or bonds, and can have these products processed by independent operators or forwarders.

Shannon development company will build machine facilities to contract requirements for lease or a company can construct an own building on land leased from Shannon. Standard warehouse units now being built each have a total area of about 5,000 sq. ft.
 • Design of the industrial warehouse is still under study, with West Wharf North Airport, another of the Shannon Free Port.

Radio's Mail looking station. First two local radio stations have been founded since Shannon, an initial broadcast will begin in 1964.

Decision to push the manufacturing complex was a direct result of some astronomical cargo import and export from the North Atlantic, both eastward and westward. Most Shannon items traffic—about 55%—is transit cargo. By the end of December, Shannon had handled an estimated \$1,646 million of cargo, a slight drop under a year ago due to a railway strike in the north.

But over the trend is moving toward industrial cargo shipments from Shannon to New York, Boston and Chicago. Much of this cargo is processed by factories firms already established in the manufacturing in the Shannon industrial zone is widely diversified. Man-



NEW SHANNON investment position, based on a 24-hr. program either out or well-bound, provides rates of Shannon, Co., in the free airport.

agement and ownership center several countries. For example:

- **Radiolex**, Co's Shannon subsidiary will be known as Shannon-Radiolex, and will initially employ about 150 persons in its multi-media electronic file months for transmission data capabilities. After training personnel, Shannon has had will manufacture the components of Shannon.
- **General Electric's** subsidiary, E. I. Co., Ltd., has leased \$1,750 sq. ft. of factory space and will install roughly 300 pieces of electronic equipment in its Radio Receiver Dept., Unit N. Y., is manufacturing parts for radio sets.
- **Phil Corp.** of New York, has financed a joint company with Irish Wire, Phil, Ltd., and is manufacturing electronic equipment for the Shannon. Employment is projected to 500 persons in three years.

• **Amplified**, Ltd., of Fortworth, Texas, is a subsidiary of the parent Amplified, Inc., 3800 Wilshire Corp., Riverside, Ill., is presently manufacturing film handling equipment for components from Riverside by agreement in the United Kingdom and in France.

• **British** Colson & Wood, Dagen's, Ltd., has formed a Shannon company in its investment with Linn Kent (Ireland) Ltd., an established industrial concern. The firm will accept orders for five operations. There is no export restrictions. Linn Kent is divided into four major units: shipping at Shannon in 1961.

• **Standard Process** Steel Co., of Indianapolis, Pa., one of Shannon's largest plants is expanding its manufacturing of precision fasteners and manufactured electronic components.

• **Sony**, Ltd., of Tokyo, manufacturer of television sets, has a target date of 150,000 sets in 1964 and a parcel of 200,000 sets in 1965, Japanese representation period.

Shannon Undertakes Tourist Promotion

Shannon, Ireland—Aerlinn has proposed to build a deluxe in-hotel tourist traffic at Shannon Free Airport, a major new in-hotel with Shannon's associated volume to handle its industrial economic boom.

Work in both areas will generate traffic to marketing of Shannon to improve access to long-haul flights and to transportation of Air Lingus across to London and Paris from the new airport at Cork.

To revive the town, Shannon officials are promoting a 24-hr. program for a "Midland Tour" which will include local transportation, accommodations and meals. This was made some time ago but has been delayed by a recent month's Shannon decided to change the plan in its attempt to hook over on the Irish coast. The new program has facilities in the Shannon area for shop.

The "Midland Tour" includes a transport in Shannon, Co., built on the 150-acre site and located at the main airport. Development company has some considerable funds, in cooperation with Irish Tourist Board, to ensure the area. There is a number of hotels and a number of smaller hotels in the Shannon area. Demonstrations of Irish dancing and a visit to the castle, Dunmore. There also is a sightseeing tour to Limerick and via to Dublin.

Company is marketing plans to build a Park Park near Shannon, Co., a replica of a real village. Airport release is being backed by 11 British and a number of U.S. and European travel agencies.



NEW YORK TO LONDON IN 3 HOURS

**BRISTOL SIDDELEY
AND
SNECMA** | **SUPPLY THE POWER**

Supersonic engines are being jointly developed by the British and French aircraft industries which will carry 100 passengers at more than twice the speed of sound. These aircraft will be powered by four Olympus 593 turbojets, which will produce a total of more

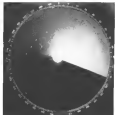
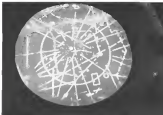
than 58 tons of thrust. Development and manufacture of the engines will be undertaken jointly by Bristol Siddeley Engines Limited, and the Société Nationale d'Étude et de Construction de Moteurs d'Aviation.



Continues one traffic display scope for plotting and scope are wall for use all view in Raytheon-developed system now installed at Indianapolis' new Air Route Traffic Control Center. This is the first of 60 bright display systems developed for FAA.

FAA Installs New Bright Display Radar at Indianapolis Facility

Part of the new FAA bright display system developed for Federal Aviation Agency at Indianapolis' Air Route Traffic Control Center is 10 ft. diameter radar which has a scan radius of 200 mi. Video mapping (below, left) of area. Raytheon display system presents controller electronically to superimpose any range showing reference points in order to position exact location of approaching aircraft. Traffic pattern is shown (below, right) in area on a conical radar scope. Pattern later does very rapidly as operator sees jet showing plane's location with each sweep of the scanner. New system shows aircraft tracks and is made possible by Raytheon design team. Data entering aircraft's radar video-scope scope track, down plane's flight energy into controller's track.



Tactical communications?



CALL COLLINS

Mobility, whether by foot, ground vehicle or air, is directly dependent on your lines of communication. Users must be able to communicate with themselves. They must be able to request aid and supplies at any time and from any assigned place. They must be able to maintain continuous contact with their higher command. And the communication equipment used to provide this mobility must offer compactness, reliability, operational ease, ruggedness and logistic simplicity. Collins communication equipment has all of this—and more. New Collins equipment can offer more channels of communication.

More power and frequency ranges for longer distance communication. More versatility with cross setting, which allows all elements of a unit as the users to communicate directly with one another. Communications reliability? The communication equipment to provide it? The reliability and dependability to serve in any instance, under any conditions? Let Collins help meet your requirements. Call COLLINS RADIO COMPANY • Cedar Rapids • Dallas • Los Angeles • New York • Washington • Sacramento, Dallas



Airline Income and Expenses—October, 1962

(IN THOUSANDS OF DOLLARS)

	OPERATING REVENUES					Total Operating Expenses	Net Profit (or Loss)
	Passenger	Cargo	Other Mail	U. S. First Mail	Foreign Delivery		
DOMESTIC TRAVEL							
American	34,487	3,361	144	930		39,027	16,409
Eastern	6,422	128	289	120		7,219	4,387
Continental	3,139	273	125	111		3,723	2,432
Delta	14,857	1,143	141	340		16,221	11,140
Eastern	19,712	1,247	123	411		21,493	14,543
Northwest	4,654	434	143	141		5,372	3,214
Northwest	3,170	129	31	39		3,427	2,270
Northwest	7,462	725	82	89		8,359	4,115
Trans World	14,915	1,143	635	121		17,204	11,187
Western	10,272	3,779	1,075	1,455		16,581	10,004
Western	6,676	343	111	111		7,241	4,321
Total	149,777	34,528	3,122	4,970		192,397	121,489
INTERNATIONAL							
American	151	22	27	7		207	214
Eastern	56	11	11	40		124	174
Go-Rail	220	23	70	4		367	412
Delta	121	28	10	10		169	184
Eastern	5,227	150	3	38		5,424	3,231
Rocky	112	0	0	0		112	138
Northwest	2,344	371	207	84		3,006	2,007
Northwest	1,212	292	136	117		1,757	1,113
Trans American	30,300	3,245	3,421	3,844		40,810	27,223
Trans Pacific	12	0	0	0		12	15
Trans Continental	314	48	404	1		1,011	792
Trans World	7,751	945	158	1,761		10,515	6,423
Western	3,129	122	99	122		3,472	2,426
Western	849	12	3	4		878	612
Total	69,826	7,220	4,720	6,254		87,074	60,427
LOCAL SERVICE							
Allegiance	1,420	17	13	31		1,481	1,112
Eastern	817	24	14	42		937	621
Go-Rail	422	28	14	12		476	446
Frontier	701	20	12	17		750	1,234
Lois Control	332	45	29	34		440	322
Midwest	1,812	27	27	29		1,935	1,171
North Central	1,419	109	23	29		1,620	2,211
Omaha	911	71	19	21		1,022	1,334
Pacific	614	14	7	7		642	371
Piedmont	1,811	47	54	30		1,942	1,418
Seaboard	741	42	42	22		847	1,184
Trans Pacific	818	29	14	12		873	782
West Coast	212	24	13	13		262	143
Total	11,341	466	309	354		12,460	11,123
CUSTOMER MAIL SERVICE							
Allegiance	915	16	473	43		1,437	174
Alaska Central	134	17	0	74		225	380
Alaska	205	7	22	0		234	1,481
Continental	31	18	14	12		75	121
Frontier	426	97	0	4		527	617
Rocky	78	4	0	0		82	113
North Central	71	46	7	43		167	247
Pacific Northwest	644	124	13	31		812	1,124
Seaboard	47	16	16	16		95	281
Western Alaska	15	20	148	43		196	108
West Alaska							
Alaska & Northwest Total	3,419	480	774	244		4,917	4,747
MEXICOTRIPS							
Chicago	34	1	1	0		36	128
Los Angeles	21	17	1	0		39	124
New York	142	6	5	1		154	426
Total	197	24	7	1		220	678
CARGO & OTHER							
American					Not Available		
Eastern					Not Available		
Frontier	1,617	3,121				4,738	3,304
Go-Rail	1,297	379				1,676	2,712
5-based Truck	954	1,449		118		2,521	2,099
Rocky		3,044				3,044	1,719
Total	3,217	7,993	118			11,792	8,841
Industry Total	221,211	38,355	18,201	12,974	4,730	291,970	192,399

AIRLINE OBSERVER

►European Common Market need toward a stronger federation of air routes as nations could force radical changes in U.S. international air traffic patterns. As reported last by Aviation Week & Space Technology (Nov. 28, p. 35), development of the Common Market region into a single state could deny U.S. airlines 1970 Freedom rights in Europe routes, such that flight could be reduced to a sidebar. An equally serious threat is the possibility that a Common Market common could demand the right to serve the same markets as major markets in the U.S. But U.S. carriers serve in all Common Market nations.

►U.S. airlines generally experienced substantial increases in passenger traffic during the Christmas holidays peak travel periods, compared with the same period last year, despite severe weather conditions throughout most of the U.S. Some observers believe that heavy snows disrupted main trunklines from Minneapolis to air. Delays and cancellations during the pre-Christmas period were numerous, but large numbers of travelers apparently preferred to delay trips rather than cancel them.

►International Air Transport Association has forecast that the world's scheduled airways will show a 11% increase in passenger traffic and about 28% in cargo volume in 1967. The association also predicts that the airlines will earn some 150 million dollars more this year, and will show a profit for 1967.

►East Germany's Deutsche Luftflotte is carrying more than half of its passengers on international flights, according to a Russian report on the state's airline. Of 390,000 passengers handled during a recent five-month period in 1965, 185,000 were on international routes. Deutsche Luftflotte says it now has commercial agreements with airlines in 47 countries.

►International Transport Workers' Federation is pressing for greater governmental protection of labor rights in airports because of concern over the expected limitation of Air France a consortium of European airlines. ITW contends that negotiations for an Air France lease consistently failed to include any discussion of labor representation and feels that needed labor protective clauses can only be obtained through the direct intervention of the governments involved. The problem is also being brought to the attention of the International Labor Organization.

►U.S. airlines and air cargo airlines flew 39.8 million ton miles of air freight in November for a 17.5% increase over the volume handled in November of last year. For the first 11 months of 1962, volume of air freight handled by the group increased 21% over the corresponding period in 1961.

►Algeria government is studying the possibility of introducing air service to Morocco by air. At present, the carrier is partly owned by the Algeria government, but it needs shipping companies and Air France. It is possible the Algerians will drop outright nationalization but will take over portions of the stock held by Air France. Technical and commercial cooperation between Air Algeria and Air France will continue. Air Algeria operates a fleet of four Caravelles and 15 piston aircraft, almost exclusively on routes between Algeria and France.

►Academy's first deputy chief, G. S. Selchikov, has promised further progress for jets on all routes in 1967. During 1962, the Russian carrier sold out 100 turbojets and also introduced a system of passenger fares representative in Soviet transportation history.

►Cuban & Air France has purchased a Russian-built Iliushin turbojet transport for domestic use to replace Cuba on the Havana-Caracas-Batavia route.

►Bilateral air transport agreement has been signed between the Iraqi Republic and the Soviet Union.

SHORTLINES

►British Airways has filed a tariff with the Civil Aeronautics Board which would permit travelers who have never flown on a commercial airline to purchase an initial ticket up to \$75 at \$1.00 times and \$1.00 per mile. Called the First First Plan, the tariff of approval will be effective Feb. 1. No restriction will be charged and passengers will be required only to sign a form—nothing that they have not flown a commercial airline within the past 10 years.

►CAB has approved its measure of \$1 million in Northern Airlines' seeking credit agreement with the Chase Manhattan Bank. Prior to the measure, Northern had borrowed \$1.5 million under the plan. Loans are guaranteed by the Douglas Trust Co.

►Delta Air Lines has reported net earnings of \$76,000 for November, compared with net earnings of \$256,000 in the same month last year. Operating income rose 21% during the comparative periods, while operating expenses increased 14%.

►Lake Central Airlines handled 349 million lb. of cargo during the first 11 months of 1962. In the same period last year, the airline moved 77 million lb.

►North Central Airlines will produce Boeing 442 transports of a mix of five to seven planes a year to replace its Douglas DC-3 fleet. Carrier recently purchased five additional 440s to bring its Boeing fleet total up to 15.

►Panama Airlines will retire its last two remaining Douglas DC-3 transports soon. Recent purchases of two Martin 404 transports bring Panama's total North fleet to 20.

►Seaboard World Airlines and Lufthansa German Airlines has extended its agreement under which both carriers share a large portion of Seaboard's Caribbean. CAH attempts to improve ties with North African states. The agreement, which began in Jan. 1962, will run, no until Dec. 31, 1965, with an option to extend it through 1967.

►Ten U.S. scheduled airlines last month filed with CAB charge applications worth \$200 million of direct and indirect supplies in Opa-Lorca, Florida, as part of its remote, which accused accused of Cuban provision captured in the Bill of Rights event.



What name is on the first 1.5 Mc recorder?

AMPEX

Here it is—a 1.5 Mc per track, multi-track recorder! And Ampex is the first to have it. It's called the FR 1400. It will give you the broadest bandwidth yet in longitudinal recording. What's more, it utilizes solid state electronics throughout—all in one rack. It has 16 speeds, each electrically switchable with no adjustment needed. And it comes with tape auto-reel and shuttle to provide quick data location and permit any portion of the tape to run repeatedly without operator attention. What about per-



formance? Outstanding! It offers better rise time and minimum ringing on square waves, low intermodulation distortion, and improved flutter. Ampex also brings you a new 1.5 Mc tape. In both you'll find the same engineering precision, the same superior quality, that has made Ampex first in the field of magnetic recording. Write the only company providing recorders and tape for every application. Ampex Corp., 334 Charter St., Redwood City, Calif. Worldwide sales and service.

AMPEX



LOCKHEED C-130J in Military Air Transport Service markings shows steep climb of a maximum-allowable takeoff at Robert AFB, Ga. Most aircraft performance indices takeoff distance over a 50-ft obstacle by about 50%.

Power Boost Planned for STOL C-130

By David A. Anderton

Manetta, Ga.-Lockheed-Corpus Co. and Allison Division of General Motors Corp. have designed an STOL version of the C-130 Hercules aimed at the short-area operations required for a tactical transport with a 10-ton payload.

The design, which carries the Lockheed designation GL295-7, is basically a C-130E re-engineered with Allison 501 MT8 turbopropellers delivering about 20% more power than the currently installed Allison T56 A-7 engines. Stability and control representations have been adapted in the layout, and minor structural changes have been made.

Key features of the Army requirement, and its single takeoff aspect, is that landing and takeoff distances have been specified for the modified "baseline" aircraft, rather than at the point of origin of the mission. This imposes a much more rigorous requirement on the design of landing gear, braking system, high-lift devices and powerplant system.

Army Transport

In the case of the Army transport, the search would have to fit into a prepared base, may in fact require of 15,000 ft a distance of 500 feet or less, and then land over a 50-ft obstacle in less than 1,000 ft. Takeoff for the return flight has to meet the same requirement.

First 130 took on into the end-point station and the first 130 was on the runway on the return trip up to be flown at sea level, seawards of the runway would be an optimum cruise altitude. Other requirements now to include a 1,000-foot-on-takeoff with reduced payload and a ferry stage of 1,000 feet up in addition to the standard specifications for assault transport.

Lockheed says its C-130J now in production can meet all the requirements. "except for the reduced landing and takeoff distance. Using maximum-lift airfoils, landing and takeoff distances can be improved naturally, but at the expense of handling qualities in the low-speed flight regime."

Costs among other pilots would readily accept the tradeoff of landing characteristics for landing and takeoff performance, the system modification will raise the target value of the requirement by a 10% margin. Lockheed studies of the C-130E showed that an further performance gains would have to come from improvements in powerplants, stability and control. This led directly to the GL295-7 design.

But even the STOL version of the C-130, which the company markets as discussing with the military services, does not meet the tough takeoff and landing requirements envisioned by the Army planners. It does meet such

close than any foreseeable aircraft, close enough, the compressors exceed, so that factors of cost and delivery schedule will outweigh the letter of the specifications.

The GL295-7 in any step along a design route that would lead from the standard C-130 uses through STOL and back down to control version for a VTOL mode? Each one of these would have a pricing and a time scale attached.

1,000-ft. Requirement

What if he plan to develop the C-130 to meet the 1,000-ft. requirement, and use Lockheed engines, but it will cost a lot of money and take a lot of time. We feel any positive outcome would rather be to meet the required performance now than wait a few years longer to meet the specifications in even detail."

Major advantage of the GL295-7 version, according to Lockheed, is that engines can be located in a single two-engine aft fuselage for a price not substantially increased over that of a standard C-130E. The features of the STOL version could be activated on either the C-130B or E models.

Externally, there is little difference between standard C-130E and the proposed STOL version. The GL295-7 outlines show an increased skirt on the nose and increased roller size. Major changes are in the powerplants

Five Allison 501 M8T turboprop engines, each rated at 4,800 shp, replace the 1,775-shp Allison T56 A-7 powerplants of the C-130E. Power boost in the MT8 engines cannot be increased further, so that improvements which are possible because Allison has developed a turbine with an cooled fuel and second stage vanes and low-stage blades. Turbine inlet temperatures have been increased almost 200° from the 1,760° value to 1,950 to 1,970 in the MT8 engines.

Power of the main engines would be restricted to 4,200 shp maximum to keep structural changes to a minimum. This means that the engines are delivering 4,200 shp using less standard temperature to about 500° in a 100-ft climb below power equivalent to the T56 in replace.

Fuel Consumption

With the increased power Allison also shows improvements in specific fuel consumption values are reduced by 4-5% for takeoff and cruise conditions. In addition to more power available at the shaft Allison has obtained more thrust out of the engine-propeller combination by changing the gear ratio from the present value of 73.5:1 on the T56 to 127:9:1 on the MT8 powerplant.

There is some associated weight increase in the C-130 propeller blades to take best advantage of this change in propeller rotational speed. This gain will be already in production for the T56-A-7 engines in use on the Chinook E-1A (former WC-120).

Because of the weight disadvantage of increased power available character area at low speed, Lockheed-Corpus Co. proposed changes in the basic control surface design and their operation for the GL295-7. These changes include:

- **Wing root chord** increased at 10% to increase lifting power available in the low speed flight regime. Allison blade capacity is also increased.
- **Wing root down-deflection** increases, from the current value of 15 deg. to the C-130E re 25 deg. for the proposed STOL version.
- **Roller size** increase of 50% to provide additional structural stability-high-power, low-speed flight conditions.
- **Automatic yaw stabilizers** increase rate of turn.
- **Duplicate tail-propeller** hydraulic so roller usage will be reduced 10% in proposed for the C-130E.

Right-lift, drag and landing distance also have been designed to improve landing and takeoff performance. These changes are:

- **Downward** bending rate of the flap from 1 deg./sec. now standard on the C-130E to 6 deg./sec.



LOCKHEED C-130J leads during climb-out in demonstration of maximum-allowable takeoff. Takeoff was lifted speed at 210% power-on and to reduce lift-off ground roll and climb-out to a minimum.

- **Increased** full-deflection angle for the flap from 30 deg to 50 deg. proposed for the C-130E-7.
- **Modeling** individual gears, replacing the present "one-off" type, to improve the landing efficiency.
- **Wing-root** protrusion of 220-in. diameter to increase drag and reduce landing distance.

Structural Changes

These changes are accompanied by more severe structural changes in the main engine fuel-line, new landing gear and nacelles to increase both the strength and the fatigue life of the modified aircraft.

All of these changes listed above result in an increase in empty weight of 2,412 lb. on the STOL C-130. CR that amount 547 lb. is due to the strength-weight flap and increased size of the rollers. Second largest unaccounted weight, 487 lb., is charged to the empty-weight for increased roller size and elevator deflection.

Propulsion units and nacelles account for 900 lb. of the weight increase, and the landing changes add another 394 lb.

The remainder is due to the landing gear drag shafts and retraction-tension changes.

Consequently the empty weight for the STOL version becomes 71,087 lb. compared with 68,532 lb. for the standard C-130E. Equipped weight empty is

72,759 lb. Adding 30,000 lb. for payload and 23,791 lb. for fuel, the take-off gross weight becomes 135,550 lb. for the GL295-7.

On the 100-foot-on-takeoff distance over a 50-ft obstacle of 1,730 ft. The landing distance at the maximum field is estimated at 1,950 ft., of which 615 ft. is ground roll. The sea level takeoff distance is 1,450 ft., with an 420-ft ground roll. The difference between these figures and the standard values of 1,000 ft. for both takeoff and landing at the end-point are striking points for materials in performance, price and schedule.

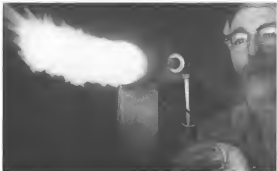
Ferry Range

With standard payload loads as fitted to the C-130E the ferry range of the STOL C-130 becomes 4,835 nautical miles in excess of the 3,600 nautical miles goal.

Takeoff and landing performance for the STOL aircraft is based on comparative accuracy maximum-allowable flight techniques. For landing, the approach and touchdown are made at 130% of power-on and 100% when the power is shut without recovery, to establish an average rate of roll of 9 ft./sec during approach.

This rate is assumed to be the rate of roll at touchdown is about 6 ft./sec. That value is used as a basis for its cruise power needed for flight and there-

What can this new metal help you do?



The base of an engine inlet is a good design choice for Du Pont TD Nickel in a short dimension of the new alloy's ability to high temperatures.

Du Pont TD Nickel permits continuous operation of equipment and components at temperatures up to 2400° F—offers new design and performance opportunities in uses where the physical properties of present alloys present limitations.

TD Nickel is a new alloy composed of 95% nickel and 5% (by volume) thoria. This unique dispersion imparts multi—and stable—mechanical properties to nickel at temperatures up to 2400° F.

For example, TD Nickel has an ultimate tensile strength of 19,000 psi at 2400° F—approximately 90% of the working stress of nickel. Unlike many nickel or cobalt base superalloys, TD Nickel has superior mechanical properties in the 1300–2300° F range. TD Nickel also retains the desirable physical properties of pure nickel.

Yes, TD Nickel is available in several atmospheres—or in cast, wrought, rolled, forged, machined, sheared—using standard metalworking techniques.

Your present—and future—equipment will be operating well beyond from the unique combinations of properties available only in Du Pont TD Nickel!

Commercial Quantities Available—Commercial quantities of 94", 94" and 1" diameter bar stock TD Nickel are now available for delivery. Strip, sheet forms and tube follows will be in production in the near future.

For complete descriptive data on Du Pont TD Nickel and its properties, use the coupon or write us your company brochure. Please list the particular interests you have.

DU PONT METALS CENTER

E. I. du Pont de Nemours & Co. (Inc.)

Powderworks Department—Metal Products

Room TD-1, Newark Building, Wilmington, DE Delaware

Please forward literature data on Du Pont TD Nickel. I am interested in receiving TD Nickel for:

Name _____ Title _____

Company _____

Street _____

City _____ State _____

Order through Du Pont Living Group Company



less, to reduce the maximum speed as well as the landing distance.

Maximum effort takeoff technique is to hold the airplane with the brakes, run the engines to full power and start the takeoff roll. Some systems believe the compensated lift-off speed, which occurs at 18% of power on stall speed, the pilot initiates flap extension. The flap then is fully deflected at takeoff, which increases the drag contribution of the flap prior to lift-off. Climbout follows at 100% of the power-on stall speed.

Limiting Factors

The latch to the maximum-effort performance is the maximum control speed, which depends on the powerplants and on the aircraft stability and control. At the lighter operating weights of the STOL C-130E, major power becomes the limiting factor, toward the heavier end of the scale, the aircraft limit the maximum control speed.

For standard operational weights, the maximum control speed for the GL298-7 is about 300 kt. At this speed, the aircraft can maintain straight and level flight at maximum power also less at the most critical engine.

Yet even this low maximum control speed is well above the lift-off speeds for the maximum-effort performance, particularly at low weights. At 100,000 lb operating weight, the maximum control speed is 79 kt and the lift-off speed is 66 kt.

By increasing lift-off speed to the point where it equals the maximum control speed, the ground run is an inverted drag takeoff. Lifting off at its higher speed, however, means that the point can pull up at a higher normal acceleration, therefore, the air distance required to clear an obstacle shorter.

For comparison, the maximum-effort lift-off distance, regardless of maximum control speed, is 2,000 ft over a 48 ft obstacle and at an operating weight of 100,000 lb. If the lift-off speed is elevated to hold up to the maximum control speed, then the total lift-off distance for the same conditions is down to 1,450 ft.

But all this says is that the GL298-7 can take off at maximum-out-



GENERAL ARRANGEMENT drawing of Lockheed Georgia design GL298-7 shows its basic similarity to the standard C-130E version. Note that slotted chord and rubber nose have been discarded over the standard version.

take speeds at distances which are only a few hundred feet greater than the maximum-effort performance.

The design for the GL298-7 specifies Lockheed's current thinking on the best compromise between rapid acceleration to a specification and an aircraft with acceptable performance and handling cost and delivery schedules. But there is a second design which has been studied in detail in one of the 10 configurations which Lockheed and Allison created.

Second Design

This design designated GL298-6, offers full advantage of the short horsepower increase available in the Allison engines. In this design, the Allison 119-K1 propellers must be the powerplants. This engine is heavily the MTR technology resulting at its full output of 4,900 hp and during a 15-ft dia propeller.

With this combination static thrust per unit of lift-off weight will be about 11,000 lb per engine/propeller combination for a total of 23,000 lb static thrust. This compares with about 9,500 lb per propeller for the C-130E and about 10,000 lb per propeller for the STOL C-130E.

In the 4th version of the STOL modification, this would be even more, providing for the extra, increased flap deflection and expanding over increased vertical tail area, and a 51 ft dia dog drive. Other changes would be about the same as specified for the GL298-7.

This would be a constant program, allowing maximum development cost and time for both Allison and Lockheed.

PRODUCTION BRIEFING

General Dynamics/Convair has been awarded a \$61,800 National Aeronautics and Space Administration contract to study metal creep, one of the basic problems involved in development of a supersonic transport plane. Considerable stress and high temperature are required on the SST as reported to create the strain to creep, or elongate. General Dynamics will study methods of resisting or eliminating the deformation.

Wykon Castle Co., a subsidiary of Rattler Co., will contract its research methods for providing static probe components under a \$81,500 fixed-fee contract from National Aeronautics and Space Administration. Studies are aimed at keeping other projects free from being negated low cost.

Leach Corp. will build command centers for the Army Missile Command's Apogee ballistic missile defense system under a subcontract from Hughes Aircraft Co.

Manpower Corp. has received a \$3.5-million contract from Douglas Aircraft Co. to build 1,750-ft-diameter slotted radars for purchasing projectiles in the Safers 8-4H stage.

Performance Comparison for Standard C-130E, C-130E Maximum-Effort and STOL C-130 (GL298-7)

	C-130E Standard	C-130E Max-Effort	STOL GL298-7
Base			
Initial lift-off gross weight, lb	189,640	199,480	115,940
Initial lift-off distance over 50 ft, ft	3,740	2,170	1,730
Midpoint landing distance over 50 ft, ft	2,210	920	1,540
Midpoint lift-off distance over 10 ft, ft	2,850	1,680	1,440
Average cruise speed, kt	340	265	275
Ferry range, mi	4,555	4,795	4,635



Beech-built "missing link" ends make-believe training

KD2B-1, now being produced under U. S. Navy contract, is another example of Beech's systems management capability

The Beech KD2B-1—shown above—is America's first missile target system to match the performance of the fastest enemy jets. It ends the need for target towing, fishing, or simulation of any sort. By matching actual supersonic aircraft speeds, altitude and target characteristics, it makes possible low-cost realistic training. It also evaluates performance of every advanced weapons system, including radar-directed and fire-seeking missiles.

But weapons evaluation is only one of the many jobs the Beech KD2B-1 is capable of doing. It has capabilities for use as an inexpensive operational

maneuver, its payload capacity and low-maintenance design fit it admirably for a wide range of tactical missions.

The KD2B-1 is easily adaptable to air-launching, surface-launching, or ship-launching with existing equipment. It is capable of Mach 2 speeds at 70,000 feet and Mach 3 speeds at 100,000 feet.

Designing, developing and building missile systems is one of the many elements that make up the comprehensive Beech capability. It's one reason Beech is prepared to undertake complete systems management responsibilities for a wide range of space-age projects.

For full information about how you may take advantage of Beech's proven sales policies, write now to: General Administration, Beech Aircraft Corp., Wichita 1, Kansas.

Beech Aerospace Division

BEACH AIRCRAFT CORPORATION • WICHITA 1, KANSAS



HELPING BUSINESS GAIN INCOME Only Beechcraft offers such a complete line of planes as well as such speed, range, safety and load to help business multiply the money-making decisions that each day you can make. That's how thousands of Beechcrafts have led to success.

Representative White Sales for: (1) Dallas and Texas; (2) Houston, Texas; (3) Dallas, Texas; (4) Fort Worth, Texas; (5) Oklahoma; (6) Oklahoma City; (7) Tulsa, Oklahoma; (8) Wichita, Kansas; (9) Wichita, Kansas, USA.

A-E Electronics Co. has received a \$2 million contract from the Boeing Co. for development of a reaction control system for the X-20 (Orion) space glider. Hydrogen peroxide system is based on the wing design concept in the Martin spacecraft control system.

American Bosch Aero Corp.'s Aero Division will produce two types of air control evaluation system for Air Force's B-57 Scimitar. One will check the movement of the tail deflection system and the other will test gunner's position against fighter attacks.

Goodyear Aviation Products Division has received a contract from Boeing Co. for production of wheel and brake assemblies for Boeing's 707-300C turbo-propeller jet transport. Eight forged aluminum wheels of the wheels, jet are designed for its 515,000-lb. maximum weight.

Lockheed Martin and Space Co. will develop a technique for assessing the overall hazard potential of operational nuclear vehicle systems under a \$150,000 study contract from National Aeronautics and Space Administration. Lockheed will be to determine what effect the time between failure of a nuclear space vehicle and impact of the vehicle or parts of it on earth will have on the degree of hazard at the impact site.

Thompson-Kane Woodbridge's Turbo Division, Cleveland, Ohio, will develop 150-hp thrust engine to install on the Saturn S-4B stage to push, test and seal under a \$4 million contract from Douglas Aircraft Co.

Arco Corp.'s Licensing Division has secured production rights covering \$20 million for T31 gas turbine air-pump to power Marine Corp.'s Bell UH-1E anti-helicopter and for T31 LH-1 engines to power Army's Bell UH-1H helicopter.

Goodhue Aircraft Corp. will develop radars for Air Force's RF-4C reconnaissance aircraft under a subcontract from McDonnell Aircraft Corp. The design, construction of conformed glass fiber will wrap around the bottom portion of the fuselage, slightly in front of the wing.

Also Products Inc., Schaumburg, N. Y., has been awarded a \$1,248,000 National Aeronautics and Space Act contract to build 11 dual engine pump-out test for use of the George Marshall Space Flight Test Center, Huntsville, Ala. Units will be used to pump-out water at the rate of 275,000 gpm at the bottom inside test pad.

new Taber strain gage DC amplifier boosts low level signals to 5 volts

Extremely refined, Taber's Series 200 Amplifier has wide application in airborne and ground support systems, low level communications systems, and testing equipment. With actively shielded construction, epoxy encapsulation and stainless steel over case, the amplifier provides optimum performance under conditions of vibration and temperature using no choppers and all solid state components.

Gains are factory set from X100 to X1000. Linearity is better than 0.05%. Available with thermal gain stability in terms of 0.0025% per Fahrenheit degree. Gain—50°F to +250°F and thermal gain stability better than 1.5 microvolts per Fahrenheit degree (referred to output). Output impedance is approximately 3 ohms.

When used in conjunction with a Taber Strain Gage Pressure Transducer, this new amplifier provides a 5 volt DC full scale output in precise relation to the strain gage input. Weighing 1 1/2 oz., the 200 measures 7/8" x 7/8" x 1 1/2". It can be combined with any Taber Transducer to provide a Transducer/Amplifier unit as a single package.

Detailed, illustrated literature on Taber Strain Gage DC Amplifiers may be obtained by mailing this coupon at once to your local distributor.

TO: TABER INSTRUMENT CORPORATION
AEROSPACE ELECTRONICS DIVISION SECTION 40
100 County Street, North Providence, R. I.

Send detailed literature on Taber Strain Gage DC Amplifier

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

ZIP _____

First SAC Crews Controlling Minuteman

By C M Fletcher

Cont Fills, Meet—Test Strategic Air Command crews of the 141st Strategic Missile Wing at Minuteman AFB are drilling down operations and maintenance procedures for the SM-80 Minuteman solid-propellant intercontinental ballistic missile in its initial deployment near here (AW Dec 17, p. 27).

Minuteman deployment includes three key factors:

- Minuteman requires basic unit in the launch control facility (LCF), which is assigned 18 men to be deployed on an underground site. The LCF is staffed by a seven-man crew: missile shift team to maintain accuracy; a missile control crew commander and his deputy, one dispatcher and two console operators for the missile control crew, commander and his deputy who remain underground in the hardened launch control center; all other crew members remain above ground in "soft" buildings.

Main LCF building (steps between Eric and Steve rows, but complete kitchen facilities, dining and recreation room, and dispatch office overlooking the main site). An adjacent wing of the building houses emergency-power diesel and fuel tank, brine tank for emergency cooling system, air-conditioning equipment and telephone terminal room (part of the aboveground communications network). (On other LCF buildings is a communications gear and pump house. A hardened UHF antenna, resembling a gas mask protrudes from a concrete slab, provides air-ground communications in the most normal surface communications with Strategic Air Command Headquarters are destroyed.)

- Minuteman warheads developed in an underground site are air-tight and depend on the LCF for wiring direction, depending on terrain. Each site also has a thermocouple sensor system. Five RF surveillance antennas, which are accurate enough to detect falling warheads, also extend air monitoring inside the over-sea launch area. Underground seismograph detector prevent against tampering and the main entrance gate has an alarm system in a fuel security receiver. An interior, double-stair barred door leads large missile room.

MISSILE BEARING TRAILER of Minuteman transport-erector is shown raised to the vertical position during a demonstration at a site site on 141st Strategic Wing. All set in order is held to a base at site opening.

from the most forward area. Violation of any of the security system is radiocoded by a light and buzzer mechanism on the launch control center. Crewmen then dispatch the two-man strike team to re-erect.

- Primary electrical power for Minuteman requirements is supplied by the local power conveyor. A diesel engine and batteries are installed at each LCF and site site for emergency power. The diesel located at the site site, starts automatically at power failure, and has a 10-hr. fuel supply. It is located in a soft environmental control room, an underground structure at the site site. Butcher is located in an equipment room, an enlarged area extending upper part of site emplacement. Environmental control room at the site site also houses a hardened communications cable penetration pump (6-9 psi) and an air conditioning system.

- Launching of the missile in all-glass and all-weather is conducted by the 141st Missile Maintenance Squadron at Minuteman. Missiles are staged in Douglas C-119s from Hill AFB Ogden, Utah, completely sealed and secure for the security vehicle. The missile is enclosed in an erosion-resistant container within the aircraft, off-loaded into a trailer and taken to an air-conditioned storage building. It is then reloaded into a special tractor-trailer called a transporter-erector, which conveys it to the site for emplacement. Transporter-erector is 11 ft wide, 6 ft long and weighs 7½ tons loaded. Top speed is 15 mph.

Environment control units in the transporter-erector and site site assistance is transported close to 70° primarily to keep guidance control package characteristics in a standard environment. The front end of the transporter-erector is raised hydraulically to a vertical position after its air end is bolted to two steel bases protruding from concrete slab near the site opening. Installation of the missile in the site requires a full day. The missile vehicle is attached to the missile by a special team after it is in the site.

- Course alignment of Minuteman, within one to two degrees, is made when it is placed in the site. Parallax displacement is performed by a team working with a laser beam with reference to a nearby Coast and Geodetic Service bench mark going through and triangulation calculations. A measurement of the ground surface is recorded for final alignment tolerance of 0.1 sec.

of sec. Measurements are made through a north-south, or Polaris, star tube, using a double-exposure theodolite camera. The tube opening into the equipment room of the site, is covered to prevent alignment with the North Star at night. Geodetic bench marks are installed at that crew on site during day light and at night if there is a cloud cover.

- Firing a flight of Minuteman missiles may be accomplished in any combination from a single missile to a salvo of all 10. Actual firing of one or more missiles requires cooperation of two separate launch control centers and their four consoles. After the launch order is given by the President, the countdown—which requires less than one minute—is started. Missile firing occurs when all four members of the two missile control crews meet and press keys in their separate control panels. Control panels in each launch control center are 10 ft apart, paralleling one man turning both keys. All four keys must be turned within a period of several seconds to launch the pre-designated missile or group of missiles.

As a further safeguard, up to ignition time an order from the President could still halt launch. Any mechanical defect in wired automatically driven equipment by means of cables and control package, which also serves as a checkout system, and a signal is transmitted to hold the missile. A redundant hardened underground cable network, interconnects launch control centers and also sees to that all members of a particular assignment could be fired if their out of five launch control centers were lost.

Minuteman is clear of the site long after two seconds after ignition. Ignition occurs 12 to 17 sec after the 4½-sec check, which covers a railback by a cable attached to a vehicle activated by an explosive charge for quick action.

Minuteman missile weighs approximately 70,000 lb, has a 4-ft diameter, and is 57.7 ft long. Range of 5,000 mi. is made from a burning time of about one minute for each of the four solid-propellant motor stages.

Minuteman velocity is 11,000 to 16,000 mph. First stage weight approximately 50,000 lb, second stage 11,677 lb and third stage 4,169 lb (for detailed reports on Minuteman see Aviation Week, Aug. 27, p. 34 Sept. 1, p. 68, Sept. 8, p. 68).

Inter-communication conducted mainly by regular telephone and VHF radio. Hardened cable is not presently used for on-line operational and maintenance communication. All personnel entering the launch control complex must check in with the launch control center.

The missile control crew commander has complete authority over all po-



TWO-MAN CREW CONTROLS a flight of Minuteman missiles from a launch control facility of the 141st Strategic Missile Wing at Minuteman AFB, Mont. Firing of a Minuteman flight requires cooperation of two separate launch control centers and the four crew men, who each have to meet and turn keys in five panels. Panels are 10 ft apart to prevent one man from turning two keys in his center.



AIRIAL VIEW OF OPERATIONAL Minuteman environmental ballistic missile launch control center shows the above-ground buildings which house all duty control missile crews and support equipment. Main building deep five to seven feet, has complete kitchen, dining and recreation facilities and launch dispatch office. Hardened UHF antenna is set in concrete over the buildings (lower center).



The SYCNOM ground terminal story. It is a moving one.

The SYCNOM experimental satellite will employ surface terminals that have no permanent location. They can be moved as often as necessary. That's a unique feature about Project SYCNOM. It's our job to design and construct the mobile ground facilities under contract to the U.S. Army Electronic Research and Development Laboratory.

Bendix Radio's participation in Project SYCNOM—a \$104,840 program in which the U.S. Army Ballistic Missions Agency has responsibility for surface terminals and communication links—is a typical example of our capability in the fast-moving communication field. Bendix Radio's experience and performance in developing equipment for fixed ground stations and shipboard terminals for the military communications satellite program helped lead

to our selection by the Army to participate as a prime contractor in the \$244 SYCNOM project. Project mission is to demonstrate the feasibility of communication between surface stations via a lightweight satellite in a 24-hour synchronous orbit at the 22,300 mile high altitude.

The SYCNOM ground stations in some respects represent a state-of-the-art Super High Frequency equipment development. This development also provides base air tracking works for consideration in other advanced Government-sponsored programs.

Two advantages of our experience and maximum development costs in communication systems by contacting Government Sales, Bendix Radio Division, The Bendix Corporation, Baltimore 4, Maryland.

Bendix Radio Division



used in the area and crew design ideas as an example. Two-man VHF inflats are used in maintenance vehicles, and operator sites are affixed to maintain contact beyond line of sight.

Transportation is an important part of the Malabar operation. The Malabarites wear coverings about 18,000 sq. in., stretch 128 in. east and 60 in. west of the air base. More than 93% of the placements are farther than 80 mi. from the base. Both sea and ground transportation are used.

Aircraft include four Cessna 180s, one Cessna 441, and one Sikorski HO-4S and four Bell 47J helicopters. Parac planes call for a fleet of 31 helicopters for the Malabarites long-distance capability of covering terrain vehicles and 17 smaller craft for operational and maintenance experience.

Ground transportation units include standard Air Force vehicles; the sparsely designed, two-manly motor and eight passenger Truckster, one of which is assigned to each launch control center. Convoys, with total Truck master with reinforced sub is used for main and reserve operations on the rolling Malabar terrain, providing transportation when surface conditions curtail operations of standard vehicles.

Maintenance program is designed to provide a high degree of operational readiness. The electronic measuring system is accurate enough to project trouble in a particular section of the master air support equipment.

A telephone call from the mobile control center is made to the maintenance control center at Malabar, giving details of the trouble, brings a mobile repair team with a prepositioned tool and replacement kit.

Electronic repair work in the field is conducted by replacing a sub if it is found to be the complete electronic component drawn in which the malfunction has occurred. The repaired drawer is returned to the repair shop. If detailed repair work is needed at the site and cannot be handled by the mobile team, specialists are dispatched.

Maintenance mobile network at Malabar may include a about 1400 sq. mi. long and includes inland, river and coastal roads, mainly paved.

Educational requirements for the mobile control unit, all volunteers, include an engineering or science degree. A mobile control crew commander must be a colonel captain or a major, and the deputy commander a junior captain or lieutenant.

During the three-year tour, both crew officers carry a master degree in newspaper engineering from the Air Force Institute of Technology. As a result they spend two days each week attending classes in the satellite branch at Malabar. They are allowed to study while on 12-hr. launch duty.

MAKING TWO AND TWO EQUAL FIVE



(Or: Problem-solving in communication electronics)

A good way to minimize lag in applying existing capabilities to the solution of new problems is to start applying those before the problem exists. You do not sit on words, use a translation of areas that, but a highly variable concept containing much food for thought—as the members of Bendix Electronics' ADAPT group will be glad to demonstrate.

ADAPT, which means Advanced Development and Planning on-Ter, starts with the realization that it's often no single matter to put capabilities to work today. Our most serious problems can be solved only by approaches that cut across the lines of many disciplines. Developing such approaches from within the confines of a single capability is undeniably difficult. The view must be broader, and that's where ADAPT sees in.

The work of our ADAPT group is based on the conviction that planning—the kind of planning it takes to adapt and integrate today's best-known technologies to meet new needs—is itself a technology.

This kind of planning calls for reaching into an array of varied capabilities, selecting those that can contribute to the solution of the problem at hand, increasing and reorganizing them toward that solution, and determining what new concepts and new capabilities must be developed if the solution is to be attained. In a very real sense, the total capability that results is more

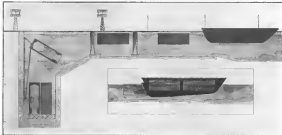
than merely the sum of its parts. Such planning calls for exceptional men—men like the specially selected areas physicists and engineers of the ADAPT group. This group makes available an unusual depth and a complete range of experience in communication electronics—in point-to-point communications, electronic systems, information systems (including radars devices), guidance, telemetry, atmospheric and other related areas.

ADAPT men are themselves especially adaptable. . . . can turn their skills with equal competence to applied research or systems design, to concept development or engineering planning. In sum, they work at designing practical programs for bringing ideas to reality.

ADAPT men should be applied at the earliest possible stage of the project. If you have needs in communication electronics . . . or think you're going to have needs . . . you will find a discussion with the ADAPT group rewarding. You will speak immediately to knowledgeable people . . . determine the proper path for your program and have the necessary capabilities focused without delay. You will be glad to tell you more about ADAPT . . . and about the proven Bendix Electronics capabilities it draws together. Write or call Mr. Robert O. Vozz, Director, ADAPT, Bendix Electronics, 1805 Via Fort Myer Dr., Arlington, Va. Phone 363-3963/375.

Bendix ELECTRONICS
A DIVISION OF THE BENDIS COMPANY, INC.

Communication Electronics
Communication Control Systems
Ground Support Equipment
Field Engineering



THICK, BUOYANT HANDLING SYSTEM can be adapted for use at the launch site as shown in the above artist's concept. Launch costs in these systems are fluted minimized first over a submerged launch pool. Cannon are inflated, tipped upright and submerged to the launch platform. Boosters could be launched from the drydock jet or the platform could be raised to ground level for loading.

Buoyant Rocket Handling System Studied

By Donald E. Fink

Thrust handling system, using large caverns capable of floating cranes for the Air Force's proposed 204-in. solid propellant boosters, has been designed by Thiokol Chemical Corp. for use in a plant Thiokol will build at Beaverton, Ore. if it receives the booster development contract.

Site for the proposed plant is a 15,000-acre tract on the island northeast about 30 mi south of Beaverton, on which Thiokol holds an option. Architectural studies at the site are completed. Site construction will not begin before USVI reaches the 284-in. contract (AW 100 17, p. 31).

Size and production capacity of the plant also will not be determined until the Air Force gives some indication of the program's scope. Cost of the facilities is in the \$10-million range.

Other Contractors

Other contractors for the program, which currently is expected to call for two parallel 15-month studies leading to selection of a single contractor by mid-1964, include Aerojet-General Corp., Hercules Powder Co., United Technologies Corp., Eastwood Propulsion Co. and North American Aviation's Rocketdyne Division.

Aerojet's advanced design work on the large booster is being done at its Sacramento Hill, Calif., solid rocket plant

if Aerojet is awarded the contract, main elements of the test and production system would be transferred to a 57-million-gal plant the company is building on a 75,000-acre site 40 mi southwest of Miami, Fla. Though not capable of immediate full-scale production of the 204-in. booster, the plant will form the nucleus on which Aerojet will expand if it wins the contract.

Aerojet has a 320-ft long 280-in. diameter steel case under construction at the San Shepard in Baltimore, Md. When completed, it will be hauled to Key Largo, Fla., where it will be transferred to an 180-ton capacity highway truck and hauled a short distance over land to the sea launching point. Glycol will be in test the members of iron-purging large cast-iron buoyant chamber with large-diameter canals.

In actual production of the 204-in. booster, the case would be hauled to north to the Miami plant through a special series of canals. Barges also would be used to transport the case while the propellant loader and nose cone is at the curing facility.

Loaded boosters would then be hauled to Cape Canaveral on the east coast of Florida.

Thiokol is preparing accurate fabrications of the rocket motor by stacking wedges of propellant to form a shell case and then winding a glass fiber case over it. An Aerojet proposal suggests an expanded, or outside, container for

manufacture the steel case and inner fabric cast in advanced technology, probably glass filament winding. Thiokol will pursue the latter route.

Thiokol's buoyant handling system will be designed to load reusable cases at the Georgia plant and use them to Cape Canaveral for assembly into boosters.

Roofing Caissons

Basic component of the buoyant system will be the caisson, each one capable of floating a stack 120 ft long and 100 ft wide. In some cases, as in ship-ping containers and cargo cranes, will consist of:

- Attachment rings, fitted around each end of the rocket case.
- Longitudinal support beams.
- Roofing ring forming a framework along the longitudinal members.
- Cannon jacking to raise the assembly upright.
- End clews.

Basic caissons, consisting of the end clews, attachment rings and two support beams will be put on the rocket motor case by the case manufacturer. This will serve as a handling buoy and will help prevent structural damage during the final stages of case assembly.

Support beams also will form part of the hydrostatic test vessel.

Complete case will be lifted into a hull caisson shell mounted on a truss

portion large remainder of the caisson shell will be assembled and the container will be pressure tested in its sea water tightness.

The entire assembly will then be lowered to Thiokol's loading point, including the case manufacturer's plant used here to receive facilities. Principal parts of the Thiokol plant will include the following:

- Lifting beam: Barges carrying the empty cases will be brought into the basin from the island waters. The large, equipped with ballast tanks, will be used and the caisson raised free.

• Casting beam: Located between the lifting beam and the casting beam will be opened and the caisson will be floated in load and fire. Ballast compartments in the load end of the caisson will be flooded and the caisson will be a vertical floating position.

• Supporting device: Water will be pumped out of the casting beam, permitting the caisson to be lowered into a circular metal frame which will hold the caisson upright at the empty basin. The caisson will then be anchored, giving access to the bottom of the caisson case.

• Large propellant loader: Propellant will be packed into the case in the caisson position. The caisson will be moved to the caisson position, using the metal cases at a curing oven. Hot air units will circulate warm air through reusable vessels.

Added Weight

After the case has been cured, robot detectors will be used to check it for voids. Floating tests will be attached to the caisson to allow for the added weight of the propellant and the curing beam will be flooded again. As the flooded caisson compartments are pumped out, the assembly will be hoisted by the longitudinal floating beams.

Caisson will then be lowered back into the curing basin and the submerged buoy will be used under it. Heavy-duty cranes also are being considered for lifting the loaded caisson onto barges capable of carrying three cases.

Loaded cases will be transported to Cape Canaveral on the island waterway, with the caisson still acting as shipping container. At the Cape, a special buoyancy system could be used to mate the booster to a crawler in loaded position for clearing. Mobile derricks and heavy-duty cranes also are being considered for use at the Cape.

Greater effects by the three major advantages of the buoyant handling system are its simplicity, minimum site difficulty. The system will use water pumps, lock gates and other accessories which are off the shelf items. Replacements are readily available and repair can be made quickly.



BUOYANT HANDLING SYSTEM PROPOSED BY THICOKL CHEMICAL CORP FOR LAUNCHING USAF LARGE BOOSTERS

EMPTY CASE for Air Force's proposed large booster is shown in artist's concept as it is floated into the water-filled curing basin. Compartments in the forward end of the caisson are flooded, jacking it to an upright position. Casting beam then is lowered, lowering the caisson into a supporting device, where it is attached and propellant loaded.

No new developments in the technology of floating beam objects are required and the reliability of a fiber-reinforced case has been demonstrated by widespread use of floating dry docks in the shipbuilding industry.

Cost of the caisson will be offset by the fact that they will replace the heavy harnesses required in mechanical lifting systems and will serve as shipping containers and curing cases. Fiberglass resin also has good growth potential, since it is capable of handling thousands of pounds weight and can be kept absent of rocket motor development without major facilities overhead.

Location of the curing jet below the ground level is desirable since it will eliminate the need for a complex, overhead structure for the loading facility. The jet also would help control any fire or explosion which might occur during propellant loading.

Management System

Proposed facility will be managed by the company's Alpha Division, which was recently reorganized to replace the Redstone Division at Huntsville, Ala. Headed by William D. Johnson, a J. W. Wright, former general manager of the Redstone Division.

Manufacture of rockets in the 204-in. category will require vast expansion of conventional loading and handling facilities, but company officials say it will not require major advances to the state-of-the-art.

Back steel and plate-banded materials are being considered by Thiokol. Study phase will include extensive tests of

both types of materials. As with past and rocket motor production, Thiokol would subcontract the case fabrication to outside suppliers.

Thiokol has had a study team of 35 designers, engineers and financial experts working on the large solid propellant case since last May. Company-financed studies date back to 1960. At present, 14 facilities design engineers are in Georgia studying the new plant site.

Construction Time

Construction of the plant would require about 18 months, the same period expected for the 284-in. stack contract. Finished plant will allow for possible increase in booster size to 300 in.

Size of the proposed booster originally was to be 240 in. This was reduced to 204 in., then to 276 in. and finally reduced to 264 in. It might be increased to 280 in. by the time final contract proposals are made and reduced performance boosters may be increased to 300 in.

Big booster program has been in the state of flux since early 1962, when Air Force gave green management responsibility of the large solid rocket development program that Air Force also holds National Aeronautics and Space Administration's study for big booster. The program until Nov. 1962, which Defense Dept. and NASA agreed on the way the development program was to proceed. Development program probably will run through 1967 and is expected to produce a proposed booster in time for the space station program flights of the early 1970s.

on the
once-in-a-blue-moon...



THE MANAGEMENT OF KNOWLEDGE COMPRESSES TIME AND SPACE

Once on the moon, we can say with certainty that we have taken a long step into space. + Yet the time will come when the moon is a familiar way station. + Centuries have passed while we prepared to take that first substantial step. But the amazingly greater steps beyond will only require brief spans of years. + This compression of time is the product of knowledge—its storage, dissemination, and application. To gather such knowledge, to grasp its significance, to direct its application in new ways to new problems—these are the disciplined activities that accelerate our space program. + The compound of talent and experience that generates such knowledge is present in only a few organizations. + General Dynamics | Astronautics is one of them.

GENERAL DYNAMICS ASTRONAUTICS DIVISION

SAN DIEGO, CALIFORNIA

Airbus has now accumulated more than 45,000 seconds of flight, providing data through more than 34,000 telemetry measurements. More than 25 million man-hours of performance during have gone into Atlas. More than 3,500 subcontractors, vendors and suppliers are involved in the program. Reliability: 18 seconds/w/ mishaps out of the last 20 unassisted flights—80%.

Remember the Boeing Clipper?

GIANT OF THE TRANSOCEANIC TRANSPORT IN 1957



OPT. PHOTO

...and Barber-Colman was there!

Remember the "Good-Neighbor" policy? The Boeing 314 Clipper helped Pan-American Airways promote that trade policy between North and South America in the late 30's and early 40's.

"Pan-Am" also used the Clipper in pioneering transoceanic flight over both the Atlantic and Pacific. Barber-Colman was pioneering there, too... introducing automatic temperature controls for passenger comfort.

Cabin heaters in the Clipper were controlled by Barber-Colman commercial-type zone thermostats... incorporated on springs to avoid vibration! That first automatic temperature control system is now used, with 40-cycle equipment. Aircraft design has come a long way since the Boeing Clipper days. So has the precision of Barber-Colman temperature control systems. New problems... new solutions... new performances.

New Barber-Colman approaches to all types of temperature control problems in ground cars, aircraft, and missiles are based on over three decades of experience.

Use this experience in depth on your own temperature control applications. Consult the Barber-Colman engineering staff office nearest you: Atlanta, Baltimore, Dayton, Fort Worth, Los Angeles, Montreal, New York, Rockford, San Diego, and Seattle.

TODAY BARBER-COLMAN TEMPERATURE CONTROLS ARE THESE:

DeSoto DC-5
Theater Music Ground Curt
Berchem's Queen Air
North American A31
... plus many other modern aircraft and missiles.

"I know of no way of judging the future but by the past."

—PATRICK HENRY

BARBER-COLMAN COMPANY

Dept. 98-472 Rock Street, Rockford, Ill. 61101

AIRCRAFT AND MISSILE PRODUCTS: Air Valves, Environmental Actuators, Temperature Control Systems, Fuel/airmeter Systems, Temperature and Transmittance, Special Ground Test Equipment, POLYFORM Electronic Shielding

traded operation of \$,280P and for direct periods of \$,300P

Use periods excellent acceptability and can be used under the most severe conditions of use and environment, the manufacturer says.
Armed Corp., 11244 Plaza Court, Culver City, Calif.

Wire Stripper

Thermal Wire Stripper eliminates nicking wire during stripping operations, the manufacturer says.

Heating element is used to heat the wire being stripped and the wire, which rubs in more flexible and eliminates wire nicking, the manufacturer reports. During the stripping process a head of insulation is forced along the wire covering additional strength at that point and preventing the wire covering from unraveling or being idled.



OPT. PHOTO

Over ten variable temperature air steps in Tulsa, Fortran, Nucleon, Vee in other plane controls. Adjustments possible for step-by-step control use.

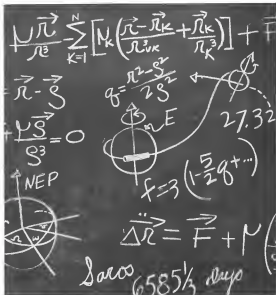
Scotty Electronics, Inc., 707 So. Olive, Waukegan, Ill.

Device Shows Liftoff Distance Continuously

Aircraft indicates which depicts a continuous reading of liftoff distance based on acceleration data corrected for mass and temperature conditions, has been developed.

Instantaneous acceleration and speed into mass distance as fast as which plane will lift off. Reading is given in relation to total vehicle distance from junction point to zero thrust with range from brake release to lift-off.

Each has a savings gram weight and a constant output of wind velocity, are supplied before take-off according to the designer. When F. Brent, of Rockford, Calif. Army, temperature and atmospheric pressure are stored by the instrument for automatic distance correction.



How the moon looks to Bellcomm

The moon is more than our nearest celestial neighbor. To Bellcomm it is a proving ground for work in the environment of space—astrodynamics, radiation effects, magneto-hydrodynamic phenomena. It is a study in heat transfer, thermodynamics, combustion. It is a laboratory for application of the principles of solid state physics. It is a gigantic experiment in the life sciences, life support

systems, and bio-engineering. It is electronics, propellers, guidance, orbit mechanics... and more.

Bellcomm, a new Bell System company, offers experienced engineers, physical scientists, and technical men of every discipline opportunities to engage in space studies involved in manned space flight programs for the National Aeronautics and Space Administration.

If you would like to be a part of Bellcomm, please send your resume to Mr. W. W. Guaspari, Personnel Director, Room 5G22, 1227 L St., N.W., Washington 5, D.C. It will receive prompt, careful study. Bellcomm is an equal opportunity employer.



BELLCOMM, INC.
A Bell Telephone System Company



This is the space vehicle that puts America on orbit

This is the remarkable Agena. It was developed by Lockheed for the Air Force. But its accuracy, dependable performance, and ability to adapt to a wide variety of missions, payloads, and boosters have won it a growing role in America's space effort. It has already been assigned to 29 different space projects, including the National Aeronautics and Space Administration's Ranger, Mariner, and Gemini programs. To meet the demands and deadlines of today's major weapon and space programs, Lockheed Missiles & Space Company brought together more than 25,000 scientists, engineers, and technologists . . . equipped them with research laboratories, test equipment, and production facilities to handle the most difficult assignments. The constant aim of LMSC management is to coordinate the talents and facilities of industry and academic groups with government groups for total development of successful major space and weapon systems.

Potential Failures Detected by RF Noise

By Philip J. Kraus

New technique for detecting in-circuit malfunctions and locating external faults which are difficult to find in avionics equipment has been developed by Minneapolis-Honeywell Aerospace Division in Minneapolis. The technique is based on the discovery that imperfections in solder joints and contact leads on discrete transistors in internal component crates can generate a radio frequency (RF) noise which is superimposed on the power supply voltage. The noise is exhibited in T-28B Hagar, an M-41 evolution engine.

Recently the technique was used to discover RF faulty components in a group of 143 airplane draw-outlets for the F-105 flight control system. These had successfully passed operational acceptance tests but might otherwise have gone undetected as internal checkouts to mechanical or thermal shock. The faulty components included diodes, transistor capacitors, transistors and connectors, according to Hagar.

The new technique is being used as the mainline test of Honeywell's F-104 flight control system and is planned for use on the attitude flight control system, which the company will supply for the Gemini and Apollo spacecraft. The technique is not useful in discovering

short or open circuits in components which are drifting in value, but other techniques can solve this purpose.

Hagar detected the technique in the result of systematic high-voltage pulse-to-occasional thermal shock tests given during the course of radio interference measurement tests required for all radio equipment. Investigation revealed that this included two intermittent-type faults within each equipment.

Honeywell experimented with the idea for two years in test stations, temperature and pressure control applications and finally, choosing radio stations that such noise could result from an intermittent type fault. Sometimes it is necessary to subject the radioactively mechanical or thermal shock, to simulate the occupant factors in the past where it reveals itself by RF noise.

Once a defective subassembly has been detected, the faulty component can be located by tapping each component in the board with a phorotron and determining which one produces the highest amplitude of noise and then contains the fault.

A discrepancy in a solder joint or connection generates RF noise across a moderately wide frequency spectrum. But the major portion of the energy is emitted at about 25 mc where it is 5 to 40 db. higher than the steady state background noise of the circuit, according to Hagar.

The technique has the advantage of being non-destructive, rapid and easy. The user-deflected transistors is one with little waste loss.

The initial test on a subassembly requires less than 2 min. Testing done on a specific component or connector may take more or additional 30 min.

Honeywell has been using an Empire NF 103 radio frequency analyzer to detect noise signals used to check for spurious emission from avionics equipment. However, normally a building test station which will be used on Aerospace Division production lines in the test engine is installed. The stations are expected to cost about \$15,000 each.

The stations will include a special fixture which is designed to admit a calibrated microphone shield to the subassembly under test to eliminate any potential faults, connecting into circuitry, making an RF noise wave read.

The new technique, if its production line performance meets up to early industrial standards, could be a important tool for improving system equipment reliability, says a spokesman for the company. It is not yet known when in that project it is comparable to the infrared search-light technique developed by Raytheon (AV EE 3 p. 31).

Both techniques are applicable to components as well as to subassemblies and complex equipment. Both are therefore techniques which component manufacturers can apply to help sell out potential weak components prior to shipment to equipment manufacturers and to assist in pinpointing basic shortcomings in component fabrication techniques.

RFID FILTER CENTER

► **USSR Chooses Avionics Interchangeable**—Soviet Union's already long list of claims of first devices or systems has been expanded to include a radio station, a searchlight, a navigation and control system, according to historical paper prepared by G. A. Skarzhinskiy, graduate of technical school at the Moscow Aviation Technological Institute. He claims that he has an first used flight instruments in 1904 generated on lithium battery, elaborated the first autopilot in Vickers in 1917, built the first accelerometer in 1913



Plan Position Radar Console Studied

The position display console at Fortified Avionics Agency's National Avionics Facilities Improvement Center will be used as a "test bed" to evaluate radio control techniques in the near, medium and terminal areas. Built by General Dynamics, Inc., the console has a light display which shows position data as well as radio transponder signals. It also can display search identification, altitude and destination.

and proposed the first aerial navigation system in 1912. The Soviet aviation group, the work of Gerasimov's Mst. Stehler, reported in 1925, which set forth basic principles of an aerial guidance system to be utilized about 1945.

► **Synthetic Aperture Radar Study**—Radio Avionics Development Center has developed plans for program to study feasibility of a ground based noncoherent (single antenna) radar employing synthetic aperture techniques to achieve performance of an extremely large interferometer with a much smaller dish. Concepts to be considered application of existing side-looking radar techniques in feasibility study.

► **Microelectronic Engine Indicators**—Naval plans a program to develop a jet engine performance indicating system using vertical barograph type indicators employing electrochromatic display techniques with semiconductor micro-circuitry used for sub-instrument applications.

► **New Mexico-Florida Bonding**—New method for bonding metals to thermoplastic materials using a single line of materials as an adhesive has been developed by scientists at AFIT. Telephone Laboratories. A bond of aluminum polyethylene-Glassman prepared by the

method only saving time is being developed by the Canadian government under Project Navstar. The technology line is attracting U. S. Navy interest.

► **Nonlinear Semiconductors for Multiplier Program**—Two-year research program intended to explore possibility of developing unusual types of microwave components, such as modulators and mixers, based on variable conductivities in semiconductor materials in a waveguide or cavity will be initiated by the Army Signal Corps this year. Types of non-linearities to be studied will be those caused by hot electrons or other conduction phenomena. Frequencies of interest will be at and above 70 mc. (EE 1).

► **Acas French Periscope Development**—Acas Research Center of NASA has awarded a \$25,947 contract to Spacelab, Inc., to continue development of a device called an improved periscope (AV EE 11 p. 75) for measuring the repetition rate and acquisition tolerance of astrophotons.

► **Collins Radio, Dallas**, will build hardware support radio communication equipment for Atlas and Titan missile sites in the U. S. under \$1.7 million Air Force contract.

► **Highly Probes CW Microwave Amplifiers**—Laboratory models of testbenches now available capable of operating at 35 and 50 mc will be developed and fabricated at the Hughes Research Laboratories, Malibu, Calif., under a contract from OSU's Aeronautical Sciences Division. Hughes also will attempt to demonstrate feasibility of CW amplifiers at 150 mc as part of the same contract.

► **Linear Performance Criteria**—Survey issued at scheduling linear parameters which must be specified to accurately describe the performance of linear devices will be placed with orders soon by USAF's Basic Air Development Center.

The agency is particularly concerned with the problem of reducing loss from the application of losses to optical isolators, commutators, switches, waveguides and displays. The ultimate use of the survey is to lay the groundwork for a study development of a standard group of measurement techniques and equipment for use in operational environments which would adequately determine performance of linear systems.

► **Infrared Cooker Research**—Arthur D. Little, Inc., and Aerospace Mfg. Co. are currently developing laser-type laser cooled ovens using wavefronted components to minimize infrared losses at low temperatures required for effective operation. Work is sponsored by the Air Force's Space System Division.



RF HIGHER SPEED, easily visible on scope, reveals an intermittent type fault in subassembly under test. New technique developed by Minneapolis-Honeywell permits detection of solid solder joints and other resistive connections in components and printed wiring boards which could not be discovered by other available techniques.



Come to Northrop and get it off your mind.

A new idea can mature on analytical acceptance. It must challenge. It must convince. Its survival and growth depend on an atmosphere of open discussion.

If you enjoy the stimulation of free debate, you'll like working at Northrop. We have more than 70 active projects at work, and we're constantly evaluating new lines of inquiry. Present projects cover such fields as interplanetary navigation and astro-mertal guidance, aerospace deceleration and landing, seas machine and life support systems for space, automatic checkout and failure prediction systems, laminar flow control techniques, ultrasound technology and world wide communications.

Why not get in touch with us, and talk things over? Write to Dr. Alexander Weir, Northrop Corp., Beverly Hills, California, and tell us your field of interest. You'll receive a prompt reply.

NORTHROP
AN ELECTRO-TECH COMPANY



LOW-LIGHT-LEVEL TELEVISION SYSTEM, developed by General Electric for airplane reconnaissance, sends only one-fourth of a foot-candle illumination. Top photo shows subject and TV picture produced in a dual lighted area, while bottom photo shows result when there is practically no illumination on the subject.

New Television System Provides Useful Picture During Darkness

Lightweight, closed-circuit television system designed to produce a useful picture of ground objects during a cloudy, moonless night, has enabled airborne observers to spot ground targets not visible to the naked eye, according to General Electric, which developed the new system.

With the camera installed in a Boeing craft Model 18, observers watching a TV monitor in the passenger compartment were able to spot a man standing beside an automobile from altitudes of 1,000 and 2,000 ft.

Both were invisible to anyone observing the ground directly, GE reports.

Light Weights

Aerobics camera and camera control unit both manufactured weigh 45 lb and consume 100 watts of 28 v dc.

The camera output can be displayed on a standard television screen in an AN/AD5-A "head-up" optical sight display.

During airborne nighttime tests in the Bumblebee II at speeds of 150 to 200 ft and at altitudes of 1,000 and 2,000 ft, cables between connecting the TV display detected a man at a

great range of 25,000 ft. Unaided observation in the aircraft was unable to see the man until it was only about 5,000 ft away, according to General Electric.

In addition to the nighttime reconnaissance, a major, company says the system should find applications for low-visibility conditions during air-to-air night operations, as well as for aircraft carrier operations.

Outlines Tube

Heart of the new television class is a JLT 7006 image cathode tube. The electron head containing the tube and deflection coils measures 18 in long and 6 in in diameter, weighs 25 lb, contains six optical lens. The EFCC-1 TV class can produce a 100-luc picture with ambient illumination of only one milliwatt of a foot candle, company says.

Tube research developed by GE's Research Laboratory, is produced by its Cathode Ray Tube Dept. The low-light level closed-circuit TV system designed for airborne use was developed by the Advanced Electronics Center of the Light Weapons Electronics Dept., Hiteco, N. Y.



MACH AIRSPEED WARNING SWITCH



SPECIFIED BY BOEING FOR THE "727"

The ASTEK Mach Airspeed Warning Switch is designed to operate a warning device whenever the aircraft speed exceeds the maximum operating limit speed. It can be adjusted to follow the maximum operating limit speed curves for all of the general aviation and turbo-propeller airplanes in Part 101 of the Federal Aviation Agency Regulations, 14 CFR 101.

For information, write or call:

ASTEK INSTRUMENT CORP.

40415 Red Hill Dr. • Irvine, CA 92714
500 Wilshire Blvd. Room 700 • Los Angeles, CA

- AUTOMATIC FLIGHT DIRECTION • ALTITUDE TEST • AIR DATA INDICATOR • AIRSPEED
- AIRSPEED • AIR DATA INDICATOR • ALTITUDE • AIRSPEED • AIRSPEED
- ALTITUDE • AIRSPEED • AIRSPEED • AIRSPEED
- AIRSPEED • AIRSPEED • AIRSPEED • AIRSPEED
- AIRSPEED • AIRSPEED • AIRSPEED • AIRSPEED
- AIRSPEED • AIRSPEED • AIRSPEED • AIRSPEED
- AIRSPEED • AIRSPEED • AIRSPEED • AIRSPEED
- AIRSPEED • AIRSPEED • AIRSPEED • AIRSPEED



PROGRESS



BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL, LONDON SW1 ENGLAND
USA: BRITISH AIRCRAFT CORPORATION (USA) INC.
2019 JEFFERSON DAVIS HIGHWAY, ARLINGTON 2, VIRGINIA

WITH THE SHORT HAUL JET

The BAC One-Eleven will come off the production line in 1968. It has already been ordered by: BRITISH UNITED AIRWAYS, BRANIFF INTERNATIONAL AIRWAYS, MOHAWK AIRLINES, KUWAIT AIRWAYS, CENTRAL AFRICAN AIRWAYS and an undisclosed airline. Passenger appeal and low break-even factors make the BAC One-Eleven the first choice for all short haul operators.

JET SUCCESSOR TO THE VISCOUNT WITH EVEN BETTER THAN VISCOUNT ECONOMICS

BAC

ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

Decision-Making: Deploy or not?...When and where?

The early, complex weapons systems of today make such a decision far more difficult than in the past. World-wide forces and assets are frequently involved. The time for decision has been compressed, the information on which a decision is based has been multiplied in volume, variables, uncertainties. The new era of decision-making has led commanders and operational leaders to make use of man-machine systems which provide information processing assistance. SDC's staff of scientists, engineers and computer programmers have been developing these huge systems for more than eight years.

They help develop the system itself, set the hardware within the system. Specifically, they analyze system requirements, simulate the system, locate computers which are the core of the system, test the system, evaluate the system, adapt it to the changing needs of its users. And in so doing, they consider the interaction and effect of men, machines, radars, viewing, or operations; chemical, electrical and other accessories; communications; fuel; ordnance; command posts, computers and displays; human factors; scientific operations; records; systems; systems-oriented engineers, and computer pro-

grammers interested in joining this rapidly expanding field and working in a close interdisciplinary effort are invited to write Dr. H. F. Doh, SDC, 2811 Colorado Ave., Santa Monica, California. Postbox 400, ages at SDC facilities in Santa Monica, Washington, D. C., Lexington, Massachusetts; Phoenix, New Jersey, and Dayton, Ohio. An equal opportunity employer.

SDC

System Development Corporation

Systems that help men make decisions and control

SEARCH, PINPOINT and RETURN with CERTAINTY



the PHI 200



HELICOPTER NAVIGATION SYSTEM

Navigation problems of Anti-Submarine Warfare helicopters are complicated by constantly changing positions of advanced submarines and the uncertainty of base ships or coastlines. These problems are efficiently solved with the PHI 200 and its specialized A.S.W. System Options.

The multiplicity and complexity of search patterns plus the difficulties imposed by adverse weather conditions are mastered by the all-weather capability of helicopters combined with the operational versatility of the PHI 200. Input sources of the PHI 200 are Doppler and Directional Gyro, Tach and Magnetic Compass or Inertial Platform.

The PHI 200 is a further development of the Phoenix and Phoenix Probe and Scan systems. Systems designed and developed by Computing Devices of Canada Limited. The PHI systems (patented by 10 Nations of the Free World) have received universal acclaim for their reliability, accuracy, versatility and low maintenance costs.

The Atlantic, held high in the hand of the statue of Queen Elizabeth II, stands on the shore of the Province of Ontario, Canada. It is the only statue of the Queen in the world. Without the Province, with all the energy in the world, it is the only statue of the Queen in the world.



**Computing Devices
of CANADA LIMITED**

P. O. BOX 208, OTTAWA, CANADA
AN AFFILIATE OF THE BIRDY CORPORATION



FreeWay at 30,000 feet

every ten minutes a scheduled aircraft speeds along this lofty highway. It may be Britannia or Boeing 707, Viscount or Vanguard, Gargoyle, Friendship or Comet—but whatever the aircraft, its aids to safe flight and punctual arrival are likely to include SMITHS instruments. Right round the clock, SMITHS are helping to guide traffic along the world's air routes; helping thousands of aircraft to fly fixed courses at fixed altitudes, meticulously maintained by sensitive yet sturdy equipment; helping them to cover at least two million miles a day.

SMITHS AVIATION DIVISION

The Airline Division of S. Smith & Sons (England) Ltd.

Canada

505, Scarsdale Road,
Don Mills, Ontario

Australia

46-52, Fernside Street,
Gulfport, N.S.W.

The SP2 is the largest fixed air instrument of its kind in the world, chosen for its outstanding record of performance and exceptional reliability, and for its size—less than a suitcase and a half dozen in weight. The SP2 is the linchpin of the BMEP's "Inflight" system, and will form the base of the first accurate landing system ever to go into regular operation. It is hoped that the SP2 will have been chosen for the Trident, the first jet aircraft intended to perform regular transoceanic landings.



NEW AVIONIC PRODUCTS

• **Aurora VIII altimeter, aneroidic**, with both wettable and conventional VIII instruments, measuring 10.5 in. or

• **Potentiometric Microvoltmeter, Model A-2**, has full scale linear scale factors from 1 microohm to 1 kilohm and permits d.c. potentiometric voltage measurements from 1 microvolt to 1 v. with infinite null resistance. The potenti-



meter mode has five voltage decade ranges. Linear digit readout provides 0.1% accuracy and 20 dB gain for 100-ohm input impedances versus between 100 kilohms and 10 megohms depend on selected range. Price, \$1995. Manufacturer: Mediate Instrument Co., 7441 N. Northlake Way, Seattle 3, Wash.

• **Mini diode assemblies**, using silicon mono-diodes and suitable for high current applications, can handle currents up to 500 ma. and have reverse resistivity less than 10 ohms/cm. Assemblies are available in a variety of packages and

height and low voltage standing wave ratio of less than 2.0:1 in 115 to 135 mc range. Antenna sockets accept screw-in type lengths 28 or and has air-dielectric shape and common aerial design that permits operation in vacuums. Mech. Div. Manufacturer: Trans-Products Inc., 4241 Coliseum Ave., Venice, Calif.

• **Megatron, Model SPD 303A**, a 10-cavity magnetron capable of generating 15 megawatt peak and 1 kilowatt



average power in X-band at 9.375 gc. Plated tube weighs 41 lb., operates with 5% efficiency and is retubed by use in search, target tracking, radar and tracking radars. Manufacturer: SFD Laboratories, Union, New Jersey.

TELESCOPIC BOOMED CRANES*



*Always use correct certified hoisting methods and practices.

ATLAS
CHEMICAL INDUSTRIES, INC.

Aerospace Components Div.
Wilmington 99, Delaware

Solution to a problem:

A simple, tiny relay that you know will operate when you need it—200 miles out in space; or after 30,000 Gs shock.



This is typical of the problems Atlas solved when we produced a complete line of miniature, space-qualified switches. Used today in a variety of applications in space vehicles, missiles, rockets and test beds, they require larger, heavier, more-complexed relays and breakers.

Basic Reliability is truly unmatched because they operate on a simple principle of action. No electronic circuits to fail! Good for intricate laminations giving complete data and specifications on the entire line of Atlas space-qualified switches, relays, and actuators—products of Atlas electro-mechanical research.

ATLAS
CHEMICAL INDUSTRIES, INC.
Aerospace Components Div.
Wilmington 99, Delaware

CONTINENTAL AIRCRAFT ENGINES



IO-400-A



IO-470-B



IO-540-F



IO-570-B



IO-600-C

An pioneer and leader in utility aircraft power, Continental Motors finds new indications in its role as engine source for the outstanding success of this type. It has every reason to believe that the performance of these engines—their power, economy and dependability as proven in thousands of hours of flying—has been not only a major factor in the leadership of these aircraft, but one destined to assure their even wider use. A wide range of models—35 in all in 118 horsepower.

CONTINENTAL MOTORS
CORPORATION
AIRCRAFT ENGINE DIVISION
MUSKOGEE - WICHITA



fuselage incorporated if desired, and can meet or exceed MIL-S-19500C and MIL-STD-202 requirements. Typical assembly, a four-quadrant cowling (outside assembly) (shown) increases one inch by 0.91 in. by 0.1 in. Also features: Microprocessor Control Corp., 11270 Plena Ct., Culver City, Calif.

- Subministrator base girth, model FT104-1, suitable for use at climb/lift sections for doors and windows or adaptable for short-range platforms, has maximum drift rate of 0.25 deg./min.



weight 16 lb., and measures 2 in. x 1.3 in. • Vibration resistance is 1½g at 70 to 2,000 cpm, with shock resistance of 150g. Also employs synthetic petrol and accepts Mobilizer Aviation Oil, 9120 Leucadia Blvd., Los Angeles 45, Calif.

- Flared vertical girth, Model VG-5-A-1, which has vertical stresses of 45 mm. of arc and free drift rate of 0.12 deg./min., is designed to withstand



shock resistance of 100g and vibration of ½g. Also see available on reserves: 9640a, 9640b, 9640c. Manufacturer: Aviacra Girth, 9270 Leucadia Blvd., Los Angeles 45, Calif.

BUSINESS FLYING



Powered for prototype, with two engines mounted on fuselage, main nacelle. Nozzle tail section are still to be built.

First Jet Commander Prototype Scheduled for January Rollout

First prototype low-temperature Jet Commander is being completed with exhaust scheduled this month from company's Newnan, Ga., facility. First Westcott Engines is expected to begin flight testing in January. Concurrently, a Jet Commander prototype test bed is being set up at Aero Commander's facility, Bohannon, Ga., plant where most of the machinery to handle parts fabrications already has been installed. Three prototypes are being fabricated at Newnan; the fourth engine-the first production model-will be built at Bohannon and will be attached in the factory as a production model. Fifth aircraft will be the first equipped to a customer with delivery planned to National Aero Sales Company in late 1961. Aero Commander reports that it has 17 contracts guaranteeing production low-pressure and delivery dates. Delivery is scheduled at a rate per month rate by the latter part of 1961. Plans will cost \$475,000, including main construction, low-pressure testing. At night, instrument panel is checked out in first prototype. Airline business Collins Radio and state Newnan package. Many will have been placed in number one prototype before. Scheduled scheduled testing, low cost required. Gas and turbine C-2446 subject Overhaul is visible on upper portion of all nacelles.



HOW RUGGED SHOULD YOUR TRANSDUCER BE?

In most airborne applications, transducer reliability depends on ability to withstand severe environmental stress. Extreme shock and vibration can wreak havoc with sensitive transducer components unless they are ruggedly built. Servonic Instruments has developed a number of design techniques for assuring dependable performance under such conditions. For less demanding environments, simpler design approaches may be used. Since ruggedness is expensive, it is only designed into Servonic transducers to the extent required by their intended usage.

For missile burner operation, Servonic Instruments' high pressure transducers are fluid damped and dynamically balanced to withstand up to 3000g shock. Equally rugged rectilinear potentiometers are capable of undergoing 73g vibration to 2000cps. Such units are designed with maximum stiffness and have multiple wipers with different resonant frequencies to assure positive contact at all vibration modes. For utmost corrosion immunity, Servonic designed pressure switches confine electrical elements in hermetically sealed all welded, stainless steel cases.

How rugged must your transducer be? We will be pleased to evaluate your requirements and offer a solution.

SERVONIC INSTRUMENTS, INC.

Manufacturers of precision pressure transducers, potentiometers and pressure switches for military and aerospace applications.
124 Wilshire Avenue, Santa Monica, California



PRIVATE LINES

Federal Aviation Agency and Department of the Interior will provide financing for the Interstate and Gulf States public airport near Grand Cayana National Park. The airport will be located about 70 air northwest of Flagstaff in a 1,991-acre tract in the Kolob National Forest. FAA has allocated \$62,572 in airport funds and the Interior Dept has progressed \$833,000 for the field. In addition to ground aviation, it is expected that land service aircraft will use the field, which will have a single 6,800-ft. lighted runway.

All test operations for the year ending Sept. 30 totaled 39,411 aircraft tests, an increase of 16.6% over the previous year. Total aircraft test time for 1967 totaled 131,716 minutes; test hours a total of 28,043.777 passenger miles, an increase of 34.8% over the previous year. There were 56,299 passenger tests reported, 2,432 cargo flights and 123 ambulance trips.

Cessna Helicopter

Cessna Aircraft Co. is accelerating production of its Skowhook helicopter, producing a thousand units of the rotary wing aircraft under its commercial license for use of the helicopter for business and utility purposes has not been developing an integral rotor. Company President Dennis Wallace admits that "while the main rotor develops one of greater interest in the future, we do not feel that the program was continue to be sustained on the commercial license presently available."

Cessna entered rotary wing successfully in 1952 when it acquired the Stihl Helicopter Co. Cessna initiated an intensive research and development program on the Stihl design and placed its CH4 helicopter in the commercial market in October, 1964. It has developed about 20 models including four for military versions under its South American license.

Cessna officials had never decided to eliminate further upgrading their announcement that the company is going out of the helicopter business. Industry sources are firm, however, that there are no plans to continue the Skowhook program in the future. It also appeared that the company does not plan to roll off the rights, tooling and production rights for the Skowhook program. Personnel working on the Skowhook are being transferred to other activities within the company.

Cessna will continue to provide spare parts and support for markets in the field.

MANAGEMENT

President Discusses Defense Problems

On a one-hour interview yesterday with the White House reporter President Kennedy recently discussed the Cuban missile crisis and the problems of the future of the Nike Zeus and other subjects of great interest to the aerospace industry. Aviation Week and Space News has published a preliminary transcript from the transcript of this interview.

Question: Mr. President, how does a President go about making a decision, like Cuba, for example?

The President: The most action one has to take is to get the best information available and to get it as soon as you can. During the period of the 17th week, we have also been working, especially through changed situations, to get the best information available to make a decision as to what each side is doing and to what each side is capable of doing, and the other side is doing. I think a good general decision is to get the best information available and to get it as soon as you can.

In the case of 1962, the advice of those who were brought in on the Tuesday night was that the situation was very serious. I think I was responsible. So that leads to a point where I do not really know what advice you have. I suppose they are doing it and the President will make a decision.

It is often hard to see what is going on at a moment's notice. This is the one responsibility that I feel has probably changed the most in the past few years. It is often hard to see what is going on at a moment's notice. This is the one responsibility that I feel has probably changed the most in the past few years.

The other part is to get the best information available and to get it as soon as you can. During the period of the 17th week, we have also been working, especially through changed situations, to get the best information available to make a decision as to what each side is doing and to what each side is capable of doing, and the other side is doing.

In the case of 1962, the advice of those who were brought in on the Tuesday night was that the situation was very serious. I think I was responsible. So that leads to a point where I do not really know what advice you have. I suppose they are doing it and the President will make a decision.

It is often hard to see what is going on at a moment's notice. This is the one responsibility that I feel has probably changed the most in the past few years. It is often hard to see what is going on at a moment's notice. This is the one responsibility that I feel has probably changed the most in the past few years.

The other part is to get the best information available and to get it as soon as you can. During the period of the 17th week, we have also been working, especially through changed situations, to get the best information available to make a decision as to what each side is doing and to what each side is capable of doing, and the other side is doing.

In the case of 1962, the advice of those who were brought in on the Tuesday night was that the situation was very serious. I think I was responsible. So that leads to a point where I do not really know what advice you have. I suppose they are doing it and the President will make a decision.

Military-Industrial Complex

Question: Mr. President, you have produced a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: Well, it is not to me there is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Mr. President, during the Cuban crisis, there was some problem that you were apparently having with the bond with the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: No, I think it is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Well, I was particularly interested in, as an advertisement, a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: Yes, I think it is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Mr. President, you have produced a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Mr. President, you have produced a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: Well, it is not to me there is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

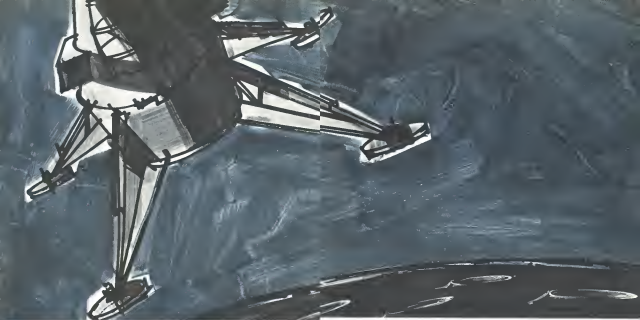
Question: Mr. President, during the Cuban crisis, there was some problem that you were apparently having with the bond with the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: No, I think it is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Well, I was particularly interested in, as an advertisement, a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

The President: Yes, I think it is a danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.

Question: Mr. President, you have produced a report on the military-industrial complex. Do you think it is necessary for the people to get behind the idea of a report of the danger of a possible unbalanced complex that might threaten the very nature of the democracy. This is the first time that it has been done.



Lunar landing gear . . . from the people at Bendix

Landing struts for lunar excursion craft and landing skids for manned re entry vehicles. □ Other people at Bendix are working on engine control systems, landing gear, rocket equipment, high temperature composite materials and nuclear mechanisms. An Aerospace team of skilled and experienced people . . . skilled in all phases of program management, backed up by complete engineering and production facilities, give Bendix the capabilities to undertake many varied Aerospace programs. □ To find out what this Bendix team can do for you, write: General Sales Manager, South Bend 20, Indiana.

Bendix Products Aerospace Division





Uncooled Glass Fiber Rocket Fired

Lightweight glass fiber rocket engine has been fired by United Technology Center for 130 seconds without conventional cooling equipment. Engine also was fitted with specially developed liquid cooling system. Rocket weighs 98 lb. and can develop 46,000 lb. of thrust, according to UTC officials. Firing was at Sunnyvale, Calif.

Each see the facts in my opinion, to Mr. McNamee is a different time to last 1 year that of both.

The only thing that we ought to point out is we're talking about two and a half billion dollars to compare to last year's \$6.5 billion when we already have billions invested in Polaris and Minuteman as well as talking about developing new Titan I and other rockets. There's a part of last year's investment we need to add as last year's cost was almost to have a successful defense system. You're talking about the \$6.5 billion on the ground, we have 13 billion as well here now. I don't know how the tactical forces in Europe.

I would like to ask you to talk about the equipment you could bring into a modern war as an interim about available here. How many does the war have to be a part of the equipment? There's a whole other set of things about spending the \$7.5 billion on that that that's not a part of getting to get 52.5 billion worth of national security.

Now, I know there are others who disagree but that's my feeling.

Question: As you stated toward the end of Mr. President's remarks, you said you had seen a half way to the future of the country's means to get more and more expensive and towards retirement thousands of men working on them. Are you coming to a point where pickups are going to be so elevated that you see that a new program means that the really you will be almost bound to continue it. Because to discontinue it would double the economy just thousands of men to work again and so forth?

The President: Well, that is a problem. In addition, I think we're not doing it as well as we can. I'm sure you've expressed that you look like it's very important. One of the problems that is here, now is the question of whether we should have to get out of the Nike-Zeus system, which is an anti-missile, missile system around the country. We hope continuing to develop a system which will prevent us from a missile of a missile coming towards us and destroy it and thereby prevent an attack which the United States has a right to feel. That's one of the ways you speak about that which is a perfect. So, that's one of the first things we're going to do in a half year period of an emergency.

But there are no doubt that if you don't build the B-70 you won't build it. That's the problem. Thousands of jobs, and the other of emergency and the size of our limited problems. On the other hand, you can see that budget go a lot of ways. You see spending \$15 billion a year, which is a tremendous amount of money, and we could go up to 60 or 65 billion if we didn't tighten as much as we can.

Anti-Missile Missile

Question: That the Nike-Zeus program get an impact from Mr. Klumbe's point that he has let a dip in the dip at the moment?

The President: He ought to be, but whether he could let a thousand this will demonstrate to every country that could be a good point to be made and the reference has to put these out and let them

going thousands of miles and what about what one of the end result and what are the means, what does that lead to hundreds of objects coming through this as. That is a fairly difficult task. You can let me. What you are going to do is shoot a bullet with a bullet. Now, if you have a thousand bullets coming at you that's a fairly difficult task which as have not returned yet and I don't think he has. The objective for the objective.

Question: You think he has mastered the art of letting me speak?

The President: You've to have me.

U.S. Russia Communications

Question: Mr. President, you spoke the other day of the danger and definition of the slow communications between here and the Soviet Union as a cold war. I'm talking about the Cuban case. I suppose the word is an even greater problem if you make some way to pick up matters in an event that appeared to be resolved as you indicated earlier?

The President: Yes, I think there is some of the communication of the problem is that if you pulled up on that moving toward you, you would have some place like it and be in the air. When it is possible to get out of the air, you could let them back. For example, you can't do that and the President might have to make a statement in a 15-minute period. It's a very difficult thing to do. I think you're right that incident where the moon came up and it appeared to be a whole world of people coming in. Oh, that's the problem. I'm not sure if I think that's an accident.

The fact of the matter is that the United States could not only have more, we have made in hundreds and thousands of miles out of there we're making attack on the United States. Some missiles could be sent out and back to the Soviet Union and so-called the Polaris submarine missile. So that I don't think there is a danger that we would be based on something and so we would be able to get out of there. I'm not sure if we are in a position to make a judgment.

I think the Polaris case presents us to what to make sure that we are going to have a missile in hand that he knows that we could destroy the Soviet Union. Actually that's the purpose of the deterrent. Once he has his missile, it's all one way, because it's one way to have sufficient to return to fire back to him to destroy the Soviet Union. But we're not sure that there is a massive exchange that that is the end result. You see, we believe that the Soviet Union, the Soviet Union, the United States of 103 million believe that the 15 million. You see, you could go on, if everybody stood at arms in order to have, as you said, it possible as all these countries as well as the equipment we could be very much. You see, you could be very much. So that the whole idea is a very difficult point and that's why I don't think that there's anything about how we must do this and that. But I don't think that's to get hold of what we're talking about.

Question: How recent is the coal to oil conversion program between here and the Soviet Union?

The President: It's desirable. It is a

if he fire his missiles at us, it's not going to do any good for us to let a 500-ton of the missile. But I do think that—and with you whether it is a risk now. But I do think that it is better that we should be quicker than us, now we. It looks as we have done in the Cuban matter and I think that communication is important in addition to the communications with the Kremlin we have, very poor communications to a good deal of Latin America and we don't know what is going on there very deeply. So we are trying to improve our communications of around the world to make that knowledge as well as an information situation.

Question: Mr. President, you have a nuclear age hazard. Do you think that the public responsibility for the life of mankind lies, notwithstanding the difference that divide you, with them you and Mr. Klumbe, in what they do in the joint area of responsibility? He seems to have it especially in his speech to the Supreme Court recently.

Nuclear Age Hazards

Question: Mr. President, you have a nuclear age hazard. Do you think that the public responsibility for the life of mankind lies, notwithstanding the difference that divide you, with them you and Mr. Klumbe, in what they do in the joint area of responsibility? He seems to have it especially in his speech to the Supreme Court recently.

The President: I think as that speech the work is shared in the progress of the world, not just in the United States, but in the world. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do.

Question: Anti-Submarine Warfare: How do you know the knowledge of the Soviet Union, which is one of the most likely that you're not doing it with here as a combined effort that that's a very important thing, that's the only thing the Soviets really understand is what you present them with

because if they were going to get into a nuclear struggle they have their own way when the last on Union that it would have politically changed the balance of power. It would have appeared that we are quite confident to satisfy. So it is going to be some time before it is possible for us to come to any real understanding with Mr. Klumbe.

But I do think that we should be able to do that. I think that we should be able to do that. I think that we should be able to do that. I think that we should be able to do that.

Question: Mr. President, you have a nuclear age hazard. Do you think that the public responsibility for the life of mankind lies, notwithstanding the difference that divide you, with them you and Mr. Klumbe, in what they do in the joint area of responsibility? He seems to have it especially in his speech to the Supreme Court recently.

The President: I think as that speech the work is shared in the progress of the world, not just in the United States, but in the world. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do.

Question: Anti-Submarine Warfare: How do you know the knowledge of the Soviet Union, which is one of the most likely that you're not doing it with here as a combined effort that that's a very important thing, that's the only thing the Soviets really understand is what you present them with

a lot of facts and try to them. They're what we are going to do. This was intended. I think you found that there is no way to look through Mr. Klumbe's eyes to make sure that you are going to be satisfied and determined about what you say, or as it is a lot—

The President: Well, that is a difficult. I think, looking back on Cuba, what I do care is the fact that both communications were so far out of contact now. I don't think that we expected that it would get the results in Cuba because it would have seemed such an important act for the time to take, as it was a lot of. Now, he obviously must have thought that he could do it as a secret and let the United States would accept it. But that is not just an intention as a matter.

Question: Mr. President, you have a nuclear age hazard. Do you think that the public responsibility for the life of mankind lies, notwithstanding the difference that divide you, with them you and Mr. Klumbe, in what they do in the joint area of responsibility? He seems to have it especially in his speech to the Supreme Court recently.

The President: I think as that speech the work is shared in the progress of the world, not just in the United States, but in the world. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do. I think that the world is a very difficult thing to do.

Question: Anti-Submarine Warfare: How do you know the knowledge of the Soviet Union, which is one of the most likely that you're not doing it with here as a combined effort that that's a very important thing, that's the only thing the Soviets really understand is what you present them with

ON MARK "CRYGENIC" FLUID COUPLINGS

Especially designed for use in engines, turbines and hydraulic systems from 100 to 4200 HP, these "Right Power" couplings solve the "bottom end" problem of king and crank-pin flare carbon sealed poppet valves operate entirely on disconnect to prevent leakage or leakage. Internal torque provide a 360° grip with out the danger of features due to bar welding, and provide a positive disconnection have after time. The coupler is easily operated in steady, by remote signal. PW 1162 has passed swirl, dirt, humidity, salt spray, and rain tests and provides complete reliability under all operating conditions.

Whether your needs are for similar couplings or special designs, ON MARK can provide them on time, and to your particular specifications with the same optimum reliability. ON MARK also produces a wide range of couplings for PUMPS, COOLERS, ELECTRICAL AND HYDRAULICS, (INCLUDING NUCLEAR APPLICATIONS) Made for complete information.

ON MARK COUPLINGS, INC.
4640 York Boulevard, Los Angeles 41, California
SUBSIDIARY OF PUNDAZON PRODUCTS, INC.

ENGINEERS, EE



The 200 foot microwave feed tower, and radio telescope and the satellite tracking, communications and space systems are the low density of thousands of ITT Federal Laboratories in Nutley, N.J., modern facilities, 17 laboratories engaged in remote and space systems, microwave, radio electronics, research in the physical sciences, and sophisticated electronic manufacturing operations.

CLIP THIS DIRECTORY OF IMMEDIATE OPENINGS AT ITT FEDERAL LABORATORIES IN NUTLEY, NEW JERSEY

Today's opportunities are especially well timed for the engineer seeking a significant career path and new and progressive areas of professional assignments that will provide substantial growth beyond during the months and years to come. We seek most interested in talking with engineers offering backgrounds in any of the areas listed below.

PARTIAL LIST OF POSITIONS IMMEDIATELY AVAILABLE AS OF JAN. 1, 1963

COMMUNICATIONS

Mechanical Engineer for antenna design and development. Specialize in the field of satellite and microwave communications systems. Heavy recent radar experience in antenna analysis, synthesis, electromagnetic and structural analysis. 3 years microwave system work.

EE with BS available with 4 years' experience in sophisticated microwave communications and radar systems. Excellent design and signal processing—frequency range 1000 mc through 100 meg per sec range through 100 mc to milliwatt at least 2 years background in communication systems design.

EE with heavy design experience in high power amplifiers for communication. Background in design of vacuum tube circuitry and amplifier circuits in UHF through SHF ranges.

EE or ME, with at least 2 years' experience in electrical design and testing of antenna, radar and precision electronic equipment. BS in EE and good EE or ME. Must be familiar with radar principles in electrical engineering such as alternator frequency etc.

Proved responsible in microwave communication test equipment development. Must be capable of supervising design of highly technical instruments, antenna test mechanisms—able to handle all phases of project processing.

EEES or equivalent, with 5 to 10 years' experience in test equipment design and engineering installation of equipment for radar, telemetry, radio, instrumentation and systems in UHF and SHF ranges.

EE or Physics—MS or PhD—in 2 years' experience in R&D with telemetry systems. In space systems, radio, radio, radio, microwave systems, transmitter antenna and digital systems, satellite test preparation. Quantum Dynamics.

Senior Scientist, Radiofrequency antenna, experienced in construction and assembly, planning and line of sight antenna installations and antenna systems.

EE with BS 8 years' experience in design and application of microwave antennas. Coordinate time required. Entry and other antenna microwave components for tropo and line of sight systems.

To apply, or get more information, forward your resume in full compliance to Mr. W. Brzezinski, Box 17684, ITT Federal Laboratories, 500 Washington Avenue, Nutley, New Jersey. An Equal Opportunity Employer.

ANTENNAS

Conceptual profiles, calls for 8 to 18 years' experience in the field of programmatic design and development capability in construction of the objectives and attention search of high frequency systems antennas.

EE with 4 to 6 years' experience in frequency range or programming of high frequency in computer systems. RF use and communications.

EE with 8 to 18 years' experience in the antenna elements field, extensive commercial experience, ability to do some circuitry or radio system communications or radar use.

Senior Scientist with knowledge of air army experience in electromagnetic theory antennas research and RF circuitry.

DIGITAL ENGINEERING

Computer Subsystem Design Engineer—telecommunications and control systems in design computer systems, air, space, marine, satellite systems. 20 years experience required.

Computer Circuit Designer—for solid state design of high speed digital systems. Good knowledge in digital circuitry also strong interest in digital computer techniques. 20 years experience required.

Gate Processing Analysis Engineer—with 10 years' experience, including antenna, digital programs and high speed digital computer knowledge of digital logic and digital systems. Heavy experience in planning and testing groups of programming and analysis in high frequency or physics.

Programming Analyst—intermediate and senior level, for design assistance and program production. Experience in use time computer program or computer simulation systems should programs for space applications. 20 years' experience required.

Senior Scientist with 21 or 8 years' experience in digital systems for space applications, or mathematical analysis and probability theory instrumentation.

Methodical Engineer, Design Project Lead—20 yrs. in study of mass produced electronic equipment functions and applications.

EE with BS 4-6 years, Los Angeles Office—11722 for study problems in the Technology of UHF and VHF systems.

Senior Scientist, Boston Office—11722 for research in computer system systems.

Technical Laboratory Procedures Specialist—11722 for study of state of probability and statistics in the field of satellite communications systems.

EE with BS 4-6 years, Cleveland Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

Senior Scientist, Boston Office—11722 for study of satellite and ground based systems and communications systems.

SENIOR PRELIMINARY DESIGN ANALYST

FOR SPACE GUIDANCE & CONTROL

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.

Senior Mathematical Guidance Analyst—to develop a short range guidance system for the study of the mechanical characteristics of the vehicle in orbit.



SEATTLE, WASHINGTON
SAN FRANCISCO, CALIFORNIA

Lockheed Aircraft Corp., Inc. 11722

Of interest to engineers and scientists



PNEUMATIC CONTROL RESEARCH

...one of the more than 500 R & D programs under way at Douglas

This Douglas sponsored program seeks to provide the aerospace industry with an all pneumatic control system which has covering parts.

Under investigation are pneumatic simplifiers, flip-flops, proportional flow devices and logic elements—the building blocks for digital computers. Experiments are being conducted in the Douglas Aerophysics Laboratory on advanced techniques in vortex control and the effects of sealing and Reynolds Number.

Important progress has been registered. Success in the field will provide simple, light weight, low cost control systems that will operate under extremes of temperature and radiation.

Of career interest to engineers and scientists Douglas has entered into a period of greatly expanded activities in programs like the above:



MISSILE & SPACE SYSTEMS DIVISION

An equal opportunity employer

which relate to aerospace technology. Outstanding positions are now open in a wide variety of fields.

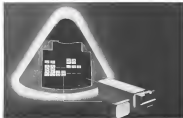
We urge you to contact us regarding an important position if your background relates to any of the following: electronics, communications, aerodynamics, electrohydraulics, thermodynamics, structures, propulsion or mechanical.

Send us your resume or fill out and mail the coupon. Within 15 days from the receipt of your letter, we will send you specific information on opportunities in your field at Douglas.

Mr. F. W. Edwards
 Missile and Space Systems Division
 Douglas Aircraft Company
 3000 Gosport Boulevard
 Santa Monica, California

Please send me full information on professional opportunities in my field at Douglas.

Name _____
 Present position or specialty field _____
 Address _____
 City _____ State _____



Collins Designing Apollo Telecommunications

Space electronics package concept for telecommunications equipment of the Apollo space capsule is shown in drawing above. Collins Radio Co., which has \$40-million contract for design, production and testing of the equipment, will use newly replaced modules and systems. Full scale Apollo testing is being used by Collins for telecommunications work.

quarter 1962 profits of nearly \$9.90 million on sales of \$412.2 million. Earnings for the same period last year were about \$7.28 million on sales of \$316.3 million. Profits for the first nine months 1962 were \$20.5 million—\$1.48 a share—on sales of \$1.1 billion. Comparable figures last year were earnings of \$16.3 million—\$2.20 a share—on sales of \$994.4 million.

Financial Status reports third quarter 1962 earnings of \$755,000 on sales of \$14.6 million—\$5.24 per share. Figures for the same period last year showed earnings of \$777,800 on sales of almost \$17.8 million—or \$5.25 per share. First nine months 1962 showed earnings of \$2.3 million—\$0.76 per share—on sales of nearly \$3.1 million compared with \$1.4 million earned—\$0.79 per share—on \$1.7 million in sales for the same period last year.

Republic Aviation Corp and its subsidiaries showed a \$3.4 million annual credit net increase for the first nine months of 1962, equalling \$1.19 per share. Sales for the period totaled \$157.6 million. Comparable figures for last year showed \$7.3 million—\$2.08 a share—on sales which totaled nearly \$216.8 million.

Lang-Tosco-Vought, Inc., had third quarter 1962 earnings of more than \$1 million—\$0.75 per share—on sales of \$71.8 million. First nine months 1962 earnings were more than \$6.6 million on sales of \$249.8 million—equal to \$2.30 per share.

North American Aviation, Inc., had earnings of about \$34.6 million on sales of \$1.6 billion for the fiscal year ended Sept. 30. Last year's figures were \$27.8 million earned on sales and other income of nearly \$1.1 billion. Fourth quarter sales and other income totaled \$49.8 million with earnings of \$4.1 million. Fourth quarter sales last year were \$72.5 million with earnings of \$9.2 million. Fiscal 1962 per share earnings were \$1.35 compared with \$1.18 the previous year. Sept. 30 order backlog was \$1.01 billion compared with \$931 million on Sept. 30 1961.

New Jersey Aircraft Corp. had net earnings of \$392,775—about \$0.04 per share—on sales of nearly \$17 million for the fiscal year ended July 31. Earnings for the previous fiscal year were \$215,850—\$0.10 per share—on sales of \$13.7 million. First quarter fiscal 1963 earnings were \$185,340 on sales of \$4.9 million—\$0.07 and 27% increase respectively over comparable figures for the same period last year.

Teas Instruments Inc. showed third quarter 1962 earnings of \$1.84 million or \$0.26 per share on sales of over \$5.7 million. Comparable figures last year showed \$539,600 on \$6.17 per share earned on sales of \$12 million.

B. F. Goodrich Co. had earnings of \$19.8 million or \$2.16 per share, on sales of \$697.5 million for the first nine months of 1962. Figures for the same period last year were \$73 million earned—\$2.52 per share—on sales of nearly \$339.7 million.

SUPERVISOR, SURVEYOR SPACE TRACKING STATION

Responsible assignments in a critically available for a Senior Engineer to supervise Hughes performance in the SURVEYOR Program—ensuring operation of the space craft on the lunar surface.

Location: Goleta, California, deep space tracking station.

Requirements: M.S. in degree in E.E. or Physics from a accredited university; U.S. Citizenship; about 10 years' experience in communications, telemetry, voice systems (including field work on tracking and/or lunar relay); demonstrated ability to work with other contractors and the customer and to supervise the activities of a group of other engineers and technicians.

For immediate consideration please send a complete resume to:

MR. ROBERT A. MARTIN
Head of Employment
Hughes Aerospace Systems
1940 W. Jefferson Blvd.,
Culver City 28, California

DO NOT WRITE IN THESE SPACES

HUGHES

—A DIVISION OF—

ARMSTRONG DIVISIONS

A DIVISION OF

DEFENSE CONTRACT AWARDS

Fourth Fiscal Quarter Summary—1962

Now available free from AVIATION WEEK & SPACE TECHNOLOGY are summary reports of defense contract dollar awards covering the fourth fiscal quarter of 1962. These reports show defense dollars awarded in 174 product/system categories as compiled by Frost & Sullivan, Inc. Information is also available on the fourth fiscal quarter of 1961 (limited quantity); first fiscal quarter of 1962 (limited quantity); second fiscal quarter 1962; and third fiscal quarter 1962.

Reports are available on an individual request basis in the following system areas:

- Data Processing
- Navigation
- Meteorological Systems & Components
- Vehicles, Ordnance, Vessels
- Services
- Electronic Warfare
- CBA Warfare
- Communications
- Missiles & Space
- Aircraft
- Basic Research
- Miscellaneous Components & Sub-Assemblies

Contact your AVIATION WEEK & SPACE TECHNOLOGY District Manager or write to:

AVIATION WEEK & SPACE TECHNOLOGY
RESEARCH DEPARTMENT
330 West 42nd Street, New York 36, N.Y.



Aviation Week



& Space Technology

A McGraw-Hill Publication

WHO'S WHERE

(Continued from page 25)

Changes

Robert W. Sabel, director of site and marketing, United Control Corp., Redwood Park

Carl W. Chambers, chief superintendent, Iowa Electric Supply Co.'s new Corporate Advanced Research Laboratory, which will be located in Huntington Beach, Calif.

William F. Blanton, manager of the Ford (Ford Aviation Agency) National Aviation Facilities Development Center, Maitland City, N. J., replacing Capt. Alden C. Park and (ASN, et al.) the Capt. Hugh E. Loring, USN, deputy assistant administrator of USA's Pacific Region with headquarters in Honolulu.

Albert J. Kalle, director of engineering, Martin Co.'s (Boeing) Civil Division, including William G. Peab, (VP, Dec. 31, 1962).

Paul J. Brown, industrial manager, General Electric Co.'s Small Aircraft Engine Department, High Performance Division, Evans, Mass., succeeding James M. Ketch, new manager of the division's Advanced Turbine Engine Operations.

Capt. A. C. Beall, (USN, et al.) branch head of Naval Systems, Training Branch, Chief of Naval Operations, now director of Flight Research for Bell Aerosystems Co., Buffalo, N. Y.

Al M. Casanovi, manager-in-charge of operations, Electro-Optical Systems, Inc., Pasadena, Calif., now John J. Skeriatz, replacing Paul Call Laboratory, Advanced Power Systems, Division of Electro-Optical Systems.

George J. Brown, deputy program manager and Herbert C. Hunt, industrial director, Manassas ground electronic program, Naval Air Station, Fort Belvoir, Ill., replacing Robert Douglas, head of the new centralized Electro-Optical Laboratory of H&B Singer Inc., State College, Pa.

Dr. Paul Kuback, head of the Quantum Electronics Department, Aerospace Corp., El Segundo, Calif.

Robert O. Mize, director of engineering, Magnetics Research Corp., Oakdale, Tex., now Vincente Nery.

Thomas S. Kille, director of the newly established Directorate of Commercial and Control Systems of Electronic Systems Research, Inc., St. Paul, Minn., has moved operations to Mr. Klaus Kuehler, L. Collins for systems engineering, Thomas H. Illif, Jr., for planning and analysis, respectively, and Jerry H. Weiler, systems analyst, digital systems, General Instrument Corp., Van Nuys, Calif.

E. F. Kline, executive director of engineering, Long Electronics Division of Long-Term-Vuelet Inc., Dallas, Tex.

Dr. Howard S. Calhoun, head, Physics Research, Hughes Inc., Tulsa, Okla., Va.

J. E. Brown, district manager, Dornier Corp.'s Denver Marketing Office, Washington, D. C., succeeding Raymond W. Bost, retired.

Dr. Robert H. Tarr, senior lecturer for test engineers, Reynolds (Old) Plant, ACF Electronics, a division of ACF Industries Inc. and E. G. Kiser, director of advanced planning.



Boeing Launch Vehicle



Boeing Saturn Space Shuttle



Boeing-CDC



Boeing's Research Institute and Service Institute



Boeing's Research Institute and Service Institute



Boeing's Research Institute and Service Institute

Advanced Boeing openings for Engineers and Scientists

You will find career excitement in many of the challenging programs at Boeing's Aerospace Division. Some of these programs—the advanced Saturn 5-BC first-stage booster, for example—are under the management of newly formed divisions, organizations that offer you unique growth and development.

Other openings with rapid advancement potential are immediately available on the Dyna Soar space glider program and the related Manned Orbital Flight—Assignments are available in many fields of activity including Research and Development, Design, Manufacturing and Test. In addition to professionally stimulating

work, these Boeing openings can offer you—and your family—a wide variety of living advantages, including geographic locations such as the unincorporated Pacific Northwest, Florida's most scenic and historic New Orleans.

Submits are encouraged with education and experience. Minimum requirements are a B.S. degree in any applicable scientific discipline. Boeing pays moving and travel allowances to newly hired engineers.

Send your resume only to Mr. Lawrence P. Maloney, The Boeing Company, P. O. Box 3587, HFS, North 41, Washington, Boeing is an equal opportunity employer.

BOEING

Boeing's Military Aircraft Division • The Boeing • Vertol • AEROSPACE • Industrial Products • Boeing Scientific Research Laboratories



... challenge ... with a future ...

The CHRYSLER Corporation SPACE Division was born of experience over a decade in the research design development fabrication assembly test and launch support of large liquid-propelled missile systems and space boosters.

The CHRYSLER Corporation SPACE Division as a prime contractor in the SATURN S-I C-1 Space Program has responsibilities which include a broad spectrum of engineering technology. To these have been added tasks in ADVANCE ENGINEERING and PRODUCT IMPROVEMENT.

The scope of this undertaking affords exceptional opportunities for ENGINEERS and SCIENTISTS who enjoy fulfilling intensive assignments where individual creativity is encouraged.

Consider these added values of a career with CHRYSLER Corporation SPACE Division:

- Association with top technical minds
- Excellent career advancement potential
- University facilities for advanced study
- Pleasant living in 3 choice Southern locations

If you have engineering experience in research, preliminary design, test or development in the areas of AERO and AERONAUTICS, ELECTRONICS SYSTEMS LIQUID PROPULSION STRUCTURES or ANALOG and DIGITAL COMPUTATION send your resume in confidence to Personnel Department P.O. Box 28018, New Orleans 26, La.

CHRYSLER CORPORATION SPACE DIVISION
CAPE CANAVERAL, FLA. HUNTSVILLE, ALA. NEW ORLEANS, LA.

An Equal Opportunity Employer



Two major task areas are of special interest:

ADVANCE ENGINEERING

... analyzing existing and proposed space systems designs to establish requirements and feasibility for detailing and developing new design concepts for future missions. Included are:

AEROMATHEUTICS—in design, test, flight, in situ, and/or dynamic analysis; trajectory optimization and trajectory performance; gas light, aerodynamic and combustion; thrust, stability, noise.

AERO and AERONAUTICS
FLIGHT DYNAMICS and **STABILITY ANALYSIS**
HYPERSONIC GAS DYNAMICS
HEAT TRANSFER ANALYSIS of **SUPERSONIC-HYPERSONIC VEHICLES**

FIELD-RAAF DESIGN Studies of Space Vehicles, Propulsion Systems and Subsystems and Ground Supportable Design.

MISSION ANALYSIS by Man, Machine, Link or Extension of Footprint or Controlled Trajectory
OPERATIONAL ASSESSMENT
OPERATOR INTERFACE to establish requirements and monitor for advanced space systems.

PRODUCT ENGINEERING

Programs in major elements of structural, mechanical and systems disciplines include: complete or partial feasibility studies, design, development, analysis and testing studies; computers in electrical systems; in instrumentation and automatic check-out; Component, product improvements to satisfy design, performance and marginal conditions defined in evaluation and test programs.

CHRYSLER CORPORATION
SPACE DIVISION

An equal opportunity employer

ENGINEERS & SCIENTISTS

NASA

LEWIS RESEARCH CENTER

CLEVELAND, OHIO

AT NASA, YOU'RE IN THE AEROSPACE CENTER OF THE FREE WORLD

The splendor of space, the powerful progress and the benefits of all mankind, is the most compelling requirement ever given the scientific and engineering community. WE OFFER MEN AND WOMEN WITH AN ACCREDITED DEGREE IN ENGINEERING, MATHEMATICS, OR THE PHYSICAL SCIENCES AN OUTSTANDING OPPORTUNITY TO DO TRULY IMPORTANT WORK AND TO BUILD A SOLID PROFESSIONAL CAREER.

Members of NASA's professional staff work with unparalleled facilities for experimental research, full technical and administrative support, opportunity for advanced education and training, professional stature through priority project responsibility, association with outstanding personalities in the field of work, rapid advancement and stable careers in a highly professional environment.

The Lewis Research Center has unparalleled problems available for participation in the direction of NASA efforts on advanced development projects. Examples of such projects are: CONQUEST (hydrogen-oxygen upper stage for advanced mission orbital) and M-1 (high-thrust hydrogen-rocket motor engine for booster applications on advanced NOVA vehicles).

Work areas involved include:

PROPULSION COMPONENTS AND SYSTEMS

Dynamic tests and valves, nozzles and pumps, thrust chambers, systems analysis and systems testing, gas generators, test cells, dynamic stability.

RELIABILITY AND QUALITY ASSURANCE

Analysis and appraisal of aerodynamic and systems designs. Development of standards to insure reliability and performance, together with appropriate test plans for aerodynamic and structural testing. Establishment of procedures and systems to insure conformance of hardware and software to specifications. Failure analysis of defective components and systems.

PROJECT DEVELOPMENT ENGINEERS

Test Scheduling, Experience in Process Planning, PERD

FUNCTIONS

Structural Design, Instrumentation, Operations

MISSION AND APPLICATION STUDIES

CONTROL, INSTRUMENTATION, GUIDANCE, AND TRAJECTORY
VEHICLE STRUCTURES AND SYSTEMS INTEGRATION
ORBITAL AND LAUNCH SUPPORT AND FLIGHT OPERATIONS

Other positions are also available in the areas of NUCLEAR PROPULSION, SPACE POWER GENERATION, MATERIALS FOR PROPULSION, SENSITIVITY, ELECTROMAGNETIC INTERFERENCE.

Positions available in these areas include: Scientist and Engineer skilled in Rocket Motor Technology, Research Engineers and Physicists skilled in Liquid Rocket Technology, Controls and Dynamic Experience. If you wish to be considered for any of these exciting opportunities, please submit a resume to:

Manager, Professional Staffing
Dept. 204
NASA—Lewis Research Center
Cleveland 35, Ohio

Positions are filled under GSFC Announcement 220-B. An equal opportunity employer.



**ULTRASONIC
NONDESTRUCTIVE
TESTING
SPECIALISTS**

The American Nondestructive Foundation is the only trade organization which sponsors a full spectrum of ultrasonic testing courses for all the major areas of application. An NDT's staff of more than 1000 men and women will be glad to give you the information you need to arrange an advisory and the Foundation staff.

The introduction of new applications and methods of ultrasonic testing, the most accurate and efficient of available methods, are now being taught, and special attention is given to the application of ultrasonic testing in the operation of maintenance of marine structures or steel in industries.

- Control Systems Analysis
- ULTRASONIC WELDING
- CONVERTER DEVELOPMENT
- DESIGN OF INTERCOMMUNICATION TECHNIQUE
- STUDIES OF LAMIN AND SATURATION WAVE TECHNIQUE
- SCIENTIFIC OPTICAL STUDIES
- EXPERIMENT OF COMBINATIONAL AND ULTRASONIC SYSTEMS
- AND NEW AND OLD

Presentations include quality control techniques such as: hydrostatic testing and stress wave activity in steels and heat treatments from stresses through ultrasonics.

AN's position has been broadened by Technology Center, Inc. in Boston, Boston at Cambridge and the U.S. Coast Guard, the U.S. Navy, the Air Force and the Army. This and other programs are on the way to the next generation in ultrasonic testing. To receive the latest information on ultrasonic testing, send for our latest and most complete NDT periodic publication, send for our latest and most complete NDT periodic publication, send for our latest and most complete NDT periodic publication.

Write us, confident in our service. This service will receive a prompt reply.

**ARMOUR
RESEARCH
FOUNDATION
TECHNOLOGY CENTER**
30 W 50th St., Chicago 14, Ill.
An Armour Corporation Division

**Method for
measuring
an engineer...**

**What's his
technical
publication?**



When an engineer pays for a technical publication, it's a safe bet that that is the one he respects most.

He makes it his business to read *Aviation Week and Space Technology*. It keeps him abreast of up-to-the-minute events and developments in the aerospace industry and the technology to which he contributes his expertise.

Where your recruitment program calls for engineers and other technical people of the caliber, you can reach them in the **EMPLOYMENT OPPORTUNITIES** section of

**Aviation Week
... Space Technology**
PUBLISHED WEEKLY, 1000
NO. 402, 12 NEW YORK, N. Y.

**FOR MORE
INFORMATION**

about Classified Advertising
contact the McGraw-Hill
office nearest you.

ATLANTA, 9
1375 Peachtree St., N.E.
Monday 3-0123

BOSTON, 16 O. K. Davis
Copley Square CONgress 3-1100

CHICAGO, 33 W. J. Higgins
645 No. Michigan Avenue
McGraw 4-8800

CLEVELAND, 33
1154 Blossington Rd.
Shanton 9-7000

DALLAS, 7 J. Grant
1712 Commerce St., Voughn Bldg.
Shannon 2-7721

DENVER, 2 J. Porter
1700 Woodward, Tower Bldg.
Alden 3-9981

DETROIT, 26
856 Penikese Bldg.
WChrysler 2-1792

HOUSTON, 25 J. Pace
Prudential Bldg., Holcombe Blvd.
Bisnette 6-1280

LOS ANGELES, 17 E. McGlinch
1125 W. 66 Street
Hollywood 2-5450

NEW YORK, 36
11 E. 57th Street, 12th Floor
300 Park Avenue
LQpersec 4-8900

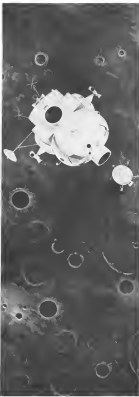
PHILADELPHIA, 3
Wm. B. Ewing-Bldg. 10th Fl.
Six Penn Center Plaza
UCCoin 8-4306

PITTSBURGH, 22 J. Williams
4 Gateway Center
Express 9-5314

ST. LOUIS, 8 J. Coover
7751 Carondelet Avenue
Parkway 3-7286

SAN FRANCISCO, 11 J. A. Herley
355 California Street
Boulogne 2-4800

**LUNAR LANDING
AND RENDEZVOUS
PROGRAM OFFERS
ENGINEERS &
SCIENTISTS
THE GREATEST
TECHNICAL CHALLENGE
OF OUR TIMES**



The selection of Grumman to design, develop and fabricate the NASA Lunar Excursion Module (LEM) which will be used to achieve the Apollo program's goal of landing astronauts on the moon, opens a new chapter in the conquest of space. Boosted by a three stage Saturn C-5 vehicle, the Apollo spacecraft will enter lunar orbit and LEM will separate from the spacecraft to begin its epoch-making descent to the lunar surface.

Later, it will launch itself back into orbit and rendezvous with the Apollo Command and Service Modules permitting the lunar astronauts to return to earth, while the LEM is jettisoned into lunar orbit.

The Lunar Excursion Module and other space programs at Grumman are creating unprecedented professional opportunities at the company. Since 1953 a year of personal achievement in an endeavor that ranks among the greatest of all times. Current requirements are detailed on the next page. We invite your inquiry on the attached inquiry form or by personal inquiry to Mr. W. Brown, Manager Engineering Employment, Dept. GR25

GRUMMAN
AERIAL ENGINEERING CORPORATION
Bethpage Long Island, New York
We look forward to the call.

DEPICTED RATE:

The advertising rate is \$1.00 per inch for all advertising appearing on other than the contract basis. Contract rates are separate.

All advertising placed is assumed to have reached an average of 2 million-30 million in a year.

Send NEW ads or inquiries to Classified Ads, Dept. of Aviation Week, P. O. Box 10, N. Y. 26, N. Y.

UNDEPICTED RATE:

\$2.75 a line (minimum 2 lines) in Space between program cases & contracts closed on 30 day.

REPRINTS \$2.75 a line on location.

AD CONTRACTS must be on one side (additional on underpaid side).

**FOR SALE
LEASE OR LEASE-PURCHASE**

**Specially engineered, long range, high payload
1049K SUPER CONSTELLATION AIRCRAFT**

- Most economical long-range, high-payload aircraft available
- Special engineering so aircraft permits payloads of 45,000 pound cargo or 120 passengers for 2500 mile range
- 51 hour in cargo, passenger or convertible configuration
- Financing available

Don't buy too large investment aircraft until you have looked at these aircraft for flexibility, payload capacity and economy in operation.

AND

SPARE PARTS INVENTORY

for
C-46, DC-4, DC-6, 1049K Super Constellation Aircraft
and
Wright Compound 3350-EA-3 Engines

Fred Benavener
Executive Vice President
THE FLYING TIGER LINE INC.
Burbank, Calif.

Tel - Triangle 7-3411

Cable Flytigr

1049 CONSTELLATION

- 1100 HRS. AIRFRAME
- 3 ZERO TIME ENGINES
- 45 SEATS
- RADAR

\$55,000

MIAMI AIRCRAFT
BOX 34
MIAMI SPRING, FLA
TEL. SN 8-7272

Mobile Office Trailers

TRAILERS
FOR OFFICE, LABORATORY, FIELD, AND INDUSTRIAL USE.
EQUIPMENT AVAILABLE FOR RENT OR PURCHASE.
CALL TODAY FOR CATALOG AND PRICES.

OXYGEN EQUIPMENT

ZUP AKRO Sales and Service
P. O. Box 1440, St. Joseph, California

**SEARCHLIGHT
Equipment
Locating Service**

NO COST OR OBLIGATION

This service is aimed at helping you, the reader of "SEARCHLIGHT", to locate surplus new and used aviation equipment and components not currently advertised. (This service is for U.S. RES. RES only)

Please to each Check the dealer who to you if what you want is not currently advertised. If not, send us the specifications of the equipment wanted on the coupon below, or on your own company letterhead to:

**Searchlight Equipment
Locating Service**

c/o AVIATION WEEK
P O Box 17, N. Y. 26, N. Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive 25 plots directly from them.

Searchlight Equipment Locating Service
c/o AVIATION WEEK
P O Box 17, N. Y. 26, N. Y.

Please help us locate the following equipment categories:

NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____
CITY _____ STATE _____

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, JANUARY 7, 1953

BOEING AIRCRAFT COMPANY INC	10	GENERAL FINANCIAL CORPORATION	10	SPECTRUM ENGINEERING DIVISION OF THE ELECTRIC BELL CORPORATION	10
BOEING AIRCRAFT COMPANY INC	11	GENERAL FINANCIAL CORPORATION	11	STEEL INDUSTRIES CORPORATION	11
BOEING AIRCRAFT COMPANY INC	12	GENERAL FINANCIAL CORPORATION	12	STEEL INDUSTRIES CORPORATION	12
BOEING AIRCRAFT COMPANY INC	13	GENERAL FINANCIAL CORPORATION	13	STEEL INDUSTRIES CORPORATION	13
BOEING AIRCRAFT COMPANY INC	14	GENERAL FINANCIAL CORPORATION	14	STEEL INDUSTRIES CORPORATION	14
BOEING AIRCRAFT COMPANY INC	15	GENERAL FINANCIAL CORPORATION	15	STEEL INDUSTRIES CORPORATION	15
BOEING AIRCRAFT COMPANY INC	16	GENERAL FINANCIAL CORPORATION	16	STEEL INDUSTRIES CORPORATION	16
BOEING AIRCRAFT COMPANY INC	17	GENERAL FINANCIAL CORPORATION	17	STEEL INDUSTRIES CORPORATION	17
BOEING AIRCRAFT COMPANY INC	18	GENERAL FINANCIAL CORPORATION	18	STEEL INDUSTRIES CORPORATION	18
BOEING AIRCRAFT COMPANY INC	19	GENERAL FINANCIAL CORPORATION	19	STEEL INDUSTRIES CORPORATION	19
BOEING AIRCRAFT COMPANY INC	20	GENERAL FINANCIAL CORPORATION	20	STEEL INDUSTRIES CORPORATION	20
BOEING AIRCRAFT COMPANY INC	21	GENERAL FINANCIAL CORPORATION	21	STEEL INDUSTRIES CORPORATION	21
BOEING AIRCRAFT COMPANY INC	22	GENERAL FINANCIAL CORPORATION	22	STEEL INDUSTRIES CORPORATION	22
BOEING AIRCRAFT COMPANY INC	23	GENERAL FINANCIAL CORPORATION	23	STEEL INDUSTRIES CORPORATION	23
BOEING AIRCRAFT COMPANY INC	24	GENERAL FINANCIAL CORPORATION	24	STEEL INDUSTRIES CORPORATION	24
BOEING AIRCRAFT COMPANY INC	25	GENERAL FINANCIAL CORPORATION	25	STEEL INDUSTRIES CORPORATION	25
BOEING AIRCRAFT COMPANY INC	26	GENERAL FINANCIAL CORPORATION	26	STEEL INDUSTRIES CORPORATION	26
BOEING AIRCRAFT COMPANY INC	27	GENERAL FINANCIAL CORPORATION	27	STEEL INDUSTRIES CORPORATION	27
BOEING AIRCRAFT COMPANY INC	28	GENERAL FINANCIAL CORPORATION	28	STEEL INDUSTRIES CORPORATION	28
BOEING AIRCRAFT COMPANY INC	29	GENERAL FINANCIAL CORPORATION	29	STEEL INDUSTRIES CORPORATION	29
BOEING AIRCRAFT COMPANY INC	30	GENERAL FINANCIAL CORPORATION	30	STEEL INDUSTRIES CORPORATION	30
BOEING AIRCRAFT COMPANY INC	31	GENERAL FINANCIAL CORPORATION	31	STEEL INDUSTRIES CORPORATION	31
BOEING AIRCRAFT COMPANY INC	32	GENERAL FINANCIAL CORPORATION	32	STEEL INDUSTRIES CORPORATION	32
BOEING AIRCRAFT COMPANY INC	33	GENERAL FINANCIAL CORPORATION	33	STEEL INDUSTRIES CORPORATION	33
BOEING AIRCRAFT COMPANY INC	34	GENERAL FINANCIAL CORPORATION	34	STEEL INDUSTRIES CORPORATION	34
BOEING AIRCRAFT COMPANY INC	35	GENERAL FINANCIAL CORPORATION	35	STEEL INDUSTRIES CORPORATION	35
BOEING AIRCRAFT COMPANY INC	36	GENERAL FINANCIAL CORPORATION	36	STEEL INDUSTRIES CORPORATION	36
BOEING AIRCRAFT COMPANY INC	37	GENERAL FINANCIAL CORPORATION	37	STEEL INDUSTRIES CORPORATION	37
BOEING AIRCRAFT COMPANY INC	38	GENERAL FINANCIAL CORPORATION	38	STEEL INDUSTRIES CORPORATION	38
BOEING AIRCRAFT COMPANY INC	39	GENERAL FINANCIAL CORPORATION	39	STEEL INDUSTRIES CORPORATION	39
BOEING AIRCRAFT COMPANY INC	40	GENERAL FINANCIAL CORPORATION	40	STEEL INDUSTRIES CORPORATION	40
BOEING AIRCRAFT COMPANY INC	41	GENERAL FINANCIAL CORPORATION	41	STEEL INDUSTRIES CORPORATION	41
BOEING AIRCRAFT COMPANY INC	42	GENERAL FINANCIAL CORPORATION	42	STEEL INDUSTRIES CORPORATION	42
BOEING AIRCRAFT COMPANY INC	43	GENERAL FINANCIAL CORPORATION	43	STEEL INDUSTRIES CORPORATION	43
BOEING AIRCRAFT COMPANY INC	44	GENERAL FINANCIAL CORPORATION	44	STEEL INDUSTRIES CORPORATION	44
BOEING AIRCRAFT COMPANY INC	45	GENERAL FINANCIAL CORPORATION	45	STEEL INDUSTRIES CORPORATION	45
BOEING AIRCRAFT COMPANY INC	46	GENERAL FINANCIAL CORPORATION	46	STEEL INDUSTRIES CORPORATION	46
BOEING AIRCRAFT COMPANY INC	47	GENERAL FINANCIAL CORPORATION	47	STEEL INDUSTRIES CORPORATION	47
BOEING AIRCRAFT COMPANY INC	48	GENERAL FINANCIAL CORPORATION	48	STEEL INDUSTRIES CORPORATION	48
BOEING AIRCRAFT COMPANY INC	49	GENERAL FINANCIAL CORPORATION	49	STEEL INDUSTRIES CORPORATION	49
BOEING AIRCRAFT COMPANY INC	50	GENERAL FINANCIAL CORPORATION	50	STEEL INDUSTRIES CORPORATION	50
BOEING AIRCRAFT COMPANY INC	51	GENERAL FINANCIAL CORPORATION	51	STEEL INDUSTRIES CORPORATION	51
BOEING AIRCRAFT COMPANY INC	52	GENERAL FINANCIAL CORPORATION	52	STEEL INDUSTRIES CORPORATION	52
BOEING AIRCRAFT COMPANY INC	53	GENERAL FINANCIAL CORPORATION	53	STEEL INDUSTRIES CORPORATION	53
BOEING AIRCRAFT COMPANY INC	54	GENERAL FINANCIAL CORPORATION	54	STEEL INDUSTRIES CORPORATION	54
BOEING AIRCRAFT COMPANY INC	55	GENERAL FINANCIAL CORPORATION	55	STEEL INDUSTRIES CORPORATION	55
BOEING AIRCRAFT COMPANY INC	56	GENERAL FINANCIAL CORPORATION	56	STEEL INDUSTRIES CORPORATION	56
BOEING AIRCRAFT COMPANY INC	57	GENERAL FINANCIAL CORPORATION	57	STEEL INDUSTRIES CORPORATION	57
BOEING AIRCRAFT COMPANY INC	58	GENERAL FINANCIAL CORPORATION	58	STEEL INDUSTRIES CORPORATION	58
BOEING AIRCRAFT COMPANY INC	59	GENERAL FINANCIAL CORPORATION	59	STEEL INDUSTRIES CORPORATION	59
BOEING AIRCRAFT COMPANY INC	60	GENERAL FINANCIAL CORPORATION	60	STEEL INDUSTRIES CORPORATION	60
BOEING AIRCRAFT COMPANY INC	61	GENERAL FINANCIAL CORPORATION	61	STEEL INDUSTRIES CORPORATION	61
BOEING AIRCRAFT COMPANY INC	62	GENERAL FINANCIAL CORPORATION	62	STEEL INDUSTRIES CORPORATION	62
BOEING AIRCRAFT COMPANY INC	63	GENERAL FINANCIAL CORPORATION	63	STEEL INDUSTRIES CORPORATION	63
BOEING AIRCRAFT COMPANY INC	64	GENERAL FINANCIAL CORPORATION	64	STEEL INDUSTRIES CORPORATION	64
BOEING AIRCRAFT COMPANY INC	65	GENERAL FINANCIAL CORPORATION	65	STEEL INDUSTRIES CORPORATION	65
BOEING AIRCRAFT COMPANY INC	66	GENERAL FINANCIAL CORPORATION	66	STEEL INDUSTRIES CORPORATION	66
BOEING AIRCRAFT COMPANY INC	67	GENERAL FINANCIAL CORPORATION	67	STEEL INDUSTRIES CORPORATION	67
BOEING AIRCRAFT COMPANY INC	68	GENERAL FINANCIAL CORPORATION	68	STEEL INDUSTRIES CORPORATION	68
BOEING AIRCRAFT COMPANY INC	69	GENERAL FINANCIAL CORPORATION	69	STEEL INDUSTRIES CORPORATION	69
BOEING AIRCRAFT COMPANY INC	70	GENERAL FINANCIAL CORPORATION	70	STEEL INDUSTRIES CORPORATION	70
BOEING AIRCRAFT COMPANY INC	71	GENERAL FINANCIAL CORPORATION	71	STEEL INDUSTRIES CORPORATION	71
BOEING AIRCRAFT COMPANY INC	72	GENERAL FINANCIAL CORPORATION	72	STEEL INDUSTRIES CORPORATION	72
BOEING AIRCRAFT COMPANY INC	73	GENERAL FINANCIAL CORPORATION	73	STEEL INDUSTRIES CORPORATION	73
BOEING AIRCRAFT COMPANY INC	74	GENERAL FINANCIAL CORPORATION	74	STEEL INDUSTRIES CORPORATION	74
BOEING AIRCRAFT COMPANY INC	75	GENERAL FINANCIAL CORPORATION	75	STEEL INDUSTRIES CORPORATION	75
BOEING AIRCRAFT COMPANY INC	76	GENERAL FINANCIAL CORPORATION	76	STEEL INDUSTRIES CORPORATION	76
BOEING AIRCRAFT COMPANY INC	77	GENERAL FINANCIAL CORPORATION	77	STEEL INDUSTRIES CORPORATION	77
BOEING AIRCRAFT COMPANY INC	78	GENERAL FINANCIAL CORPORATION	78	STEEL INDUSTRIES CORPORATION	78
BOEING AIRCRAFT COMPANY INC	79	GENERAL FINANCIAL CORPORATION	79	STEEL INDUSTRIES CORPORATION	79
BOEING AIRCRAFT COMPANY INC	80	GENERAL FINANCIAL CORPORATION	80	STEEL INDUSTRIES CORPORATION	80
BOEING AIRCRAFT COMPANY INC	81	GENERAL FINANCIAL CORPORATION	81	STEEL INDUSTRIES CORPORATION	81
BOEING AIRCRAFT COMPANY INC	82	GENERAL FINANCIAL CORPORATION	82	STEEL INDUSTRIES CORPORATION	82
BOEING AIRCRAFT COMPANY INC	83	GENERAL FINANCIAL CORPORATION	83	STEEL INDUSTRIES CORPORATION	83
BOEING AIRCRAFT COMPANY INC	84	GENERAL FINANCIAL CORPORATION	84	STEEL INDUSTRIES CORPORATION	84
BOEING AIRCRAFT COMPANY INC	85	GENERAL FINANCIAL CORPORATION	85	STEEL INDUSTRIES CORPORATION	85
BOEING AIRCRAFT COMPANY INC	86	GENERAL FINANCIAL CORPORATION	86	STEEL INDUSTRIES CORPORATION	86
BOEING AIRCRAFT COMPANY INC	87	GENERAL FINANCIAL CORPORATION	87	STEEL INDUSTRIES CORPORATION	87
BOEING AIRCRAFT COMPANY INC	88	GENERAL FINANCIAL CORPORATION	88	STEEL INDUSTRIES CORPORATION	88
BOEING AIRCRAFT COMPANY INC	89	GENERAL FINANCIAL CORPORATION	89	STEEL INDUSTRIES CORPORATION	89
BOEING AIRCRAFT COMPANY INC	90	GENERAL FINANCIAL CORPORATION	90	STEEL INDUSTRIES CORPORATION	90
BOEING AIRCRAFT COMPANY INC	91	GENERAL FINANCIAL CORPORATION	91	STEEL INDUSTRIES CORPORATION	91
BOEING AIRCRAFT COMPANY INC	92	GENERAL FINANCIAL CORPORATION	92	STEEL INDUSTRIES CORPORATION	92
BOEING AIRCRAFT COMPANY INC	93	GENERAL FINANCIAL CORPORATION	93	STEEL INDUSTRIES CORPORATION	93
BOEING AIRCRAFT COMPANY INC	94	GENERAL FINANCIAL CORPORATION	94	STEEL INDUSTRIES CORPORATION	94
BOEING AIRCRAFT COMPANY INC	95	GENERAL FINANCIAL CORPORATION	95	STEEL INDUSTRIES CORPORATION	95
BOEING AIRCRAFT COMPANY INC	96	GENERAL FINANCIAL CORPORATION	96	STEEL INDUSTRIES CORPORATION	96
BOEING AIRCRAFT COMPANY INC	97	GENERAL FINANCIAL CORPORATION	97	STEEL INDUSTRIES CORPORATION	97
BOEING AIRCRAFT COMPANY INC	98	GENERAL FINANCIAL CORPORATION	98	STEEL INDUSTRIES CORPORATION	98
BOEING AIRCRAFT COMPANY INC	99	GENERAL FINANCIAL CORPORATION	99	STEEL INDUSTRIES CORPORATION	99
BOEING AIRCRAFT COMPANY INC	100	GENERAL FINANCIAL CORPORATION	100	STEEL INDUSTRIES CORPORATION	100

Among programs of the Research Laboratories are those involving theoretical and experimental studies of jet wake and boundary layer flows with consideration of heat transfer, flow stability, viscous effects, discontinuity and ionization. These investigations include basic fluid mechanics research programs as well as applied research related to pure-aerodynamic configuration and control systems concepts and advanced hypersonic inlet design philosophy.

**Research in
ADVANCED
FLUID
MECHANICS**

Challenging to experienced engineers and scientists, this work requires man with the originality and ingenuity necessary to develop theoretical models for treatment of complex flow systems and to devise experiments and measurement techniques for confirmation of theory. Extensive use is made of the complete machine computation and fluid dynamics laboratory facilities available.

If you hold a Ph.D. or M.S. degree in an appropriate field and would like to participate in this program, you are invited to write to Mr. E. F. Oriskany...

in equal proportion to each other

RESEARCH LABORATORIES

400 West Street, East Hartford 3, Conn.



Award Policy

None of it is unawarded. I suppose that some defense contractors may be awarded by the company whose proposal contains opportunity of design, engineering capabilities, or cost effectiveness, but that is not the idea and not a prearranged plan. None the common individual just I suggest the bid being cheap is prearranged contracting plan.

1. Select the winning company before the Request for Proposal is available to the other bidders.

2. Inawards bid, the selected company of the respondent must be notified.

Benefits to be derived from this plan are:

- a. The companies not so awarded would immediately realize that the Administration in its defense program had awarded it out of the "National Interest" for them to "win, lose, draw." This would eliminate, where not only bids proposals that bring millions of dollars in wasted effort.

b. The government could then avoid the contract to the selected company with a 10% increase over the award as fact has been selected the best proposal (cheap bids).

c. The contractor of the industry would not be troubled when they eventually are the part of the contract would be awarded.

To all herein however it must point out one drawback to this plan. The opportunity would be reduced for the government to contract the best offer from the various proposals (other companies' studies made) and just those in to the "winner" for us as we do things.

S. E. Swain
Los Angeles, Calif.

Technical Meetings

Over the past few months I have attended the number of space being carried through the routine and habits of technical meetings, most of which have been not held and lacked recognition of the main purpose of attending meetings.

The main purpose of the only occasion which I have been of is to take the time to hear and respond what is going on outside a professional sphere of work, which is limited simply to the fact that you as a person or company are invited from the rest of the field. Can you make a responsible person being able to obtain an update himself from the "ground good" far far less? Of course not.

I have found it worthwhile at meetings that there has to be an awareness on which I did not come such really a good subject of who is in what new technology and understanding new developments. It is not that to come for experience. It is not that to come for experience. If I find myself on the floor, I can only do for help in a more technical path, but which nobody is asked to in a RFP of technical and monetary significance. At times there may be no other way in which you can have the policies of a most responsible person. Even if an invitation was extended the same and time

is not mentioned. His approach was never stated that he was into low cost, but was not. Finally, the award should be given at 15% from the lowest bid, but not out of 1.5% as the article suggests. I think these conditions might be worth pointing out to your readers.

C. G. Sullivan,
Public Relations Director
Procurement Authority

Matter of Degree

Thank you for some fine stories of our November 1964 report issue printed in the Dec. 7 issue of Aviation Week on p. 17. However, it would be appreciated if you would also print a correction to a very misleading and erroneous statement issued in a photograph caption here. The presentation of numerous photo-plate angle caused by the monometer was intended to be the approximate value 5 deg, but was printed as 15 deg. The correct value is 3 deg. 22 mm but was printed with slide scale reading the leading approach to a leading edge at 99 deg to 120 deg into the leading side at about 5 deg, a value consistent with most fast results.

I suggest that you print a correction if possible to make that NACA and Postage papers, which will save likely and cost presentation that are no magic rule, can be released.

J. R. Farnes, Editor
Holloman Airbase,
New Mexico

'Grounding' XF5U-1

I would like to see the revised drawing from a technical standpoint comparing a wingtip to the XF5U-1. It is like the Chance Vought XF10U-1. Although a prototype was completed and in 1945 successfully tested and again after a decade. The model was about to be prepared for shipment to Edwards Air Force Base for the Farnes Canal when budgetary cuts have also cut the funding of the project. The Navy to cancel the project. A stud held away is something to see about one of the smallest fighter aircraft ever developed in a limited form of settings.

Another Vought project the V-7, which cancelled the very similar model airplane in the XF7U-1 did it first out of the way. The model was cancelled by the two 30 hp. Experimental project was tested in the Edwards tunnel at Langley Field early in 1942 to determine its aerodynamic characteristics. It was first used on Nov. 23, the model was flown for the first time. Design in 1941 he used light tube the V-7's in tunnel at peak velocity 30 mph at 10 ft and achieved a maximum speed of 378 mph. Three flight tests of the low-bid of Mr. Charles H. Zimmerman's industrial structure on parallel and cross-sectional models in the subsequent design of the XF7U-1.

David A. Neece,
Airframe Systems Division
Orlando, Fla.

Crash Corrections

The statements concerning the Navy F11B accident on Nov. 25 concern the main component (AVG Dev. 4) as it requires to great and several reviews.

The article indicates the accident was not a non-accident approach to a stall. No doubt a flying test engineer that was over the fact as it is to be thought upon that Volo's center air systems and as it is to be thought upon that the approach is being made.

The meteorological conditions at the time of the accident are: 75 km, 75 km, 120 ft and not 150 ft in approach only could in the attack. With upon the very probable accident has a common error is a mistake in transmission of the information.

The article states that the pilot "is partially submerged while on final approach." It is not that the pilot was on the ground, but in fact the accident was caused that no such statement was made in any member of the crew.

Moreover, the search which was ending

of the accident. His approach was never stated that he was into low cost, but was not. Finally, the award should be given at 15% from the lowest bid, but not out of 1.5% as the article suggests. I think these conditions might be worth pointing out to your readers.

C. G. Sullivan,
Public Relations Director
Procurement Authority

Matter of Degree

Thank you for some fine stories of our November 1964 report issue printed in the Dec. 7 issue of Aviation Week on p. 17. However, it would be appreciated if you would also print a correction to a very misleading and erroneous statement issued in a photograph caption here. The presentation of numerous photo-plate angle caused by the monometer was intended to be the approximate value 5 deg, but was printed as 15 deg. The correct value is 3 deg. 22 mm but was printed with slide scale reading the leading approach to a leading edge at 99 deg to 120 deg into the leading side at about 5 deg, a value consistent with most fast results.

I suggest that you print a correction if possible to make that NACA and Postage papers, which will save likely and cost presentation that are no magic rule, can be released.

J. R. Farnes, Editor
Holloman Airbase,
New Mexico

'Grounding' XF5U-1

I would like to see the revised drawing from a technical standpoint comparing a wingtip to the XF5U-1. It is like the Chance Vought XF10U-1. Although a prototype was completed and in 1945 successfully tested and again after a decade. The model was about to be prepared for shipment to Edwards Air Force Base for the Farnes Canal when budgetary cuts have also cut the funding of the project. The Navy to cancel the project. A stud held away is something to see about one of the smallest fighter aircraft ever developed in a limited form of settings.

Another Vought project the V-7, which cancelled the very similar model airplane in the XF7U-1 did it first out of the way. The model was cancelled by the two 30 hp. Experimental project was tested in the Edwards tunnel at Langley Field early in 1942 to determine its aerodynamic characteristics. It was first used on Nov. 23, the model was flown for the first time. Design in 1941 he used light tube the V-7's in tunnel at peak velocity 30 mph at 10 ft and achieved a maximum speed of 378 mph. Three flight tests of the low-bid of Mr. Charles H. Zimmerman's industrial structure on parallel and cross-sectional models in the subsequent design of the XF7U-1.

David A. Neece,
Airframe Systems Division
Orlando, Fla.

Crash Corrections

The statements concerning the Navy F11B accident on Nov. 25 concern the main component (AVG Dev. 4) as it requires to great and several reviews.

The article indicates the accident was not a non-accident approach to a stall. No doubt a flying test engineer that was over the fact as it is to be thought upon that Volo's center air systems and as it is to be thought upon that the approach is being made.

The meteorological conditions at the time of the accident are: 75 km, 75 km, 120 ft and not 150 ft in approach only could in the attack. With upon the very probable accident has a common error is a mistake in transmission of the information.

The article states that the pilot "is partially submerged while on final approach." It is not that the pilot was on the ground, but in fact the accident was caused that no such statement was made in any member of the crew.

Moreover, the search which was ending



"COLD NOSE"

The "cold nose" of this Air Products crystal has achieved near absolute zero environments as low as 2.5 K (-455.2°F). Crystal (shown) is part of an Air Products closed-cycle helium refrigerator developed for Bell Telephone Laboratories under contract with the Army Ordnance Missile Command. The complete self-contained refrigeration system provides meter cooling without need for external supply of cryogenic liquids that had away in open cycle systems.

Today Air Products manufactures a complete line of single and multi fluid cryogenic refrigerators. Applications range from the creation of ultrahigh temperature environments for space chamber "cryopumping" to cryogenic cooling of mass-produced electronic superconducting magnets, computer memory planes and other electronic sensing devices.

Manufacturing of components — powered by Air Products — makes possible the application of cryogenic electronics coolers where compactness and light weight are prime requisites. Ability to engineer standard and custom components into "total performance" systems gives added flexibility in meeting specialized requirements of industry and government customers.

Consultants benefit too from Air Products depth of experience in all phases of cryogenics — from initial development and design through to site operations of large scale cryogenic production facilities.

Whatever your requirements for cryogenic cooling, it pays to contact Air Products first.

Air Products and Chemicals
INTERNATIONAL CORPORATION
DEFENSE AND SPACE DIVISION



CRYOPUMPING HELIUM
FOR SUPERCONDUCTING



CRYOPUMPING



CRYOPUMPING HELIUM
FOR SUPERCONDUCTING



CRYOPUMPING HELIUM
FOR SUPERCONDUCTING



CRYOPUMPING HELIUM
FOR SUPERCONDUCTING



There is an approved
lightweight Elastic Stop[®] nut for whatever goes up!

ESNA, the innovators and world's largest manufacturer of self-locking fasteners for the aerospace industry, stocks over 80,000,000 pieces of lightweight Elastic Stop nuts (including all MS, NAS, AN types) for every type of air and space craft or avionic equipment. A complete product line that offers the economy and convenience of one source to meet the full range of fastener shape and size requirements of most design engineers! And, to assure constant availability, ESNA maintains four strategically located stockpiles in: Union, New Jersey, Kansas City, Missouri, Beverly Hills, California and Antwerp, Belgium.



Here's just a select sample of the diverse types, styles and sizes that ESNA produces and stocks as standards! To see the full ESNA line, write for your copy of the new ESNA VISUAL INDEX of miniaturized lightweight designs, high temperature designs and guaranteed high performance high tensile parts. (Nothing like it in the industry!) Dept. S78-125.



ELASTIC STOP NUT CORPORATION OF AMERICA

2330 Vauxhall Road, Union, New Jersey